

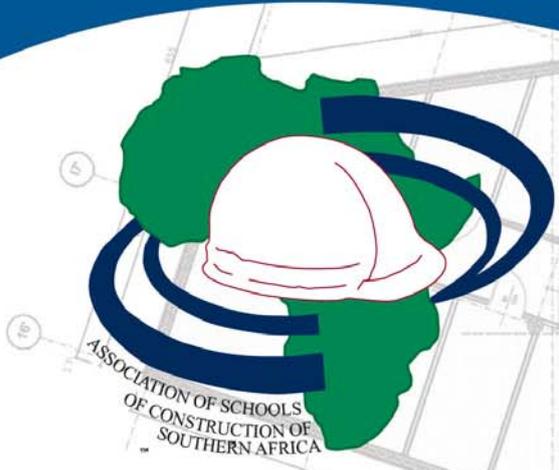


Association of Schools of
Construction of Southern Africa

The 6th Built Environment Conference



Johannesburg - South Africa
31st July - 2nd August 2011



**THE SIXTH BUILT ENVIRONMENT
CONFERENCE
JOHANNESBURG SOUTH AFRICA
31 JULY – 2 AUGUST 2011**



PREFACE

The Sixth Built Environment conference provided in the aftermath of a global economic downturn an international forum for researchers and practitioners from developed, developing and underdeveloped nations to address fundamental problems and constraints that affect the Built Environment. The broad objectives of the conference were:

- To provide a forum for multi-disciplinary interaction between academics and practitioners;
- To provide an internationally recognized, accredited conference for the built environment;
- To disseminate innovative and cutting edge practices, and
- To contribute to the built environment body of knowledge (BEBOK).

The organizers brought together in a single forum researchers, academics, administrators and practitioners representing educational institutions, government agencies, contracting organizations, consulting enterprises, financial institutions, and other construction related organizations. The conference had a broad scope and topics were organized around the conference theme of The Built Environment.

In particular, the conference sought responses to the following critical questions:

- What changes would lead to improvements?
- How can informal technology contribute to improvement?
- What are the barriers to change?
- What economic levers can be used?
- How can informal construction sector and SMME problems be addressed?
- How can education, training, and professional development be improved?
- How can all industry participants be integrated?
- How can communication and management difficulties be addressed?
- How can safety, health, and environment risks be better recognized, understood and avoided?
- How can diversity and exclusivity be promoted?
- How can the regulatory environment be more effective?

These internationally peer reviewed and edited proceedings were aimed at contributing significantly to the body of knowledge relative to the science and practice of construction and the improvement of construction health and safety on sites not only in South Africa but everywhere that construction is being done.

Theo C Haupt
Johannesburg, South Africa
July 31, 2011

ACKNOWLEDGEMENTS

The organizing committee of The Sixth Built Environment conference, held in Sandton, Johannesburg, South Africa, wish to thank the University of Johannesburg, the Council of the Association of Schools of Construction of Southern Africa and membership universities and individuals for supporting this conference through their valued contributions.

Without the substantial financial support of the major conference sponsor the Construction Industry Development Board (CIDB) this conference and the further development and growth of the Association of Schools of Construction of Southern Africa (ASOCSA) with respect to its mission in the region would not have been possible. Further, this support demonstrates the commitment of the sponsors to the further development of the body of knowledge relative to the science and practice of construction. This commitment is deeply valued and acknowledged.

Our thanks are extended to Professor Theo Haupt (Mississippi State University and University of Johannesburg), Ferdinand Fester (University of Johannesburg) and the Council of ASOCSA who worked unstintingly on every aspect of the conference. Together with the Scientific and Technical Committee and additional reviewers to whom special thanks are extended they worked hard and long to prepare refereed and edited papers and published proceedings of the highest standard that satisfy the criteria for subsidy by the South African Department of Education.

Special mention is necessary for Clinton Aigbavboa, Professor Didibhuku Thwala for their efforts relative to this conference - often under extremely difficult and trying circumstances.

The contribution and excellent support of our webmaster, Wendal Koopman, in setting up and supporting our conference website is appreciated.

Finally, the sterling contribution and efforts of Ferial Lombardo and her staff at Madison Media to the success of this conference is acknowledged in their capacity as conference organizers working with the conference committee and evident in the superlative logistic coordination and attention to detail in every aspect of the conference organization.

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PEER REVIEW PROCESS

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- Research methodology and robustness of analysis of findings;
- Empirical research findings; and
- Critical current literature review.

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Association of Schools of Construction of Southern Africa

History

ASOCSA is not the first attempt to form a body that addresses, inter alia, matters of construction education and training. In the days of the Building Industries Federation South Africa and the National Development Fund there were regular annual meetings of the Heads of Departments that offered construction-related programs. Recognizing the two-tiered higher education sector in South Africa, there were separate meetings for universities and the former technikons. In the more recent past, the Chartered Institute of Building - Africa initially convened annual educators' forums that did not quite fulfill the same function as the previous forums. However, during 2005 the very first meeting of University Heads of Departments drawn from all higher education institutions in South Africa met for the very first time since the re-landscaping of the sector in the same venue to discuss matters affecting construction, and particularly construction education in the country. This meeting was repeated in 2006 where the need was expressed for the establishment of a formal forum / association of universities to engage in discussion / debate / collaboration / promotion of matters of mutual interest.

Broad Aims

ASOCSA aims to be the professional association for the development and advancement of construction education in Southern Africa, where the sharing of ideas and knowledge inspires, guides and promotes excellence in curriculums, teaching, research and service. To achieve this aim ASOCSA is partnering with the construction industry to find ways to effectively represent the interests of both construction academic and industry practitioners. ASOCSA will offer a variety of programs and services designed to help its members serve their customers more effectively and succeed in an increasingly challenging environment of construction information management and technology. To this end ASOCSA provides a forum for the debate and discussion of issues of mutual interest to all industry stakeholders. For example, one of the tasks of ASOCSA will be supporting the development of curriculums that address the needs of the construction sector in the Southern African region. ASOCSA convenes an annual conference where construction academics and practitioners can interact relative to practical experience and the findings of relevant research.

The Journal of Construction presently published twice per year is the official journal of ASOCSA and more than 5,000 complimentary copies are distributed to all industry stakeholders in the Southern African region. The production and distribution of practice notes and technical papers is a further endeavor to grow the partnership between academia and industry.

With respect to the Southern African region, ASOCSA is committed to the following:

Vision

To drive innovative construction related higher education

Mission Statement

To promote, facilitate, develop and monitor the relevance and quality of construction related curricula, research and graduates in conjunction with higher education institutions, industry and government.

Strategic objectives

The objectives of the Association are:

- to promote and facilitate the development of curricula for construction related programmes
- to facilitate accreditation of construction related programmes
- to hold an annual conference that acts as a forum for multi-disciplinary interaction between academics and practitioners
- to publish an accredited research-based journal and contribute to the built environment body of knowledge (BEBOK)
- to disseminate information dealing with construction education and related matters
- to develop and maintain closer links with industry and government
- to represent the collective views of its members
- to liaise with other organisations and persons to promote the interests of its members
- to promote and support relevant postgraduate research
- to provide bursaries to postgraduate students in accordance with set criteria

ASOCSA continues to seek opportunities to promote both academic and industry employment opportunities. Finally, ASOCSA intends to play a significant role in the accreditation of construction-related academic programs.

Meeting of Heads of Schools and Departments of Construction

ASOCSA believes that meetings of Heads of School and Departments of Construction is a vital component of its functions and holds Heads meetings at the end of each conferences in addition to bi-annual Heads meetings.

International Affiliation

ASOCSA has commenced discussions about closer collaboration with similar institutions such as the Associated Schools of Construction (ASC) in the United States, the Royal Institute of Chartered Surveyors (RICS) and the Chartered Institute of Building (CIOB). ASOCSA has entered into a Memorandum of Understanding with the International Council For Research and Innovation In Building And Construction (CIB).

In summary, benefits of membership of ASOCSA which are self-evident include participation in meetings of Heads of construction programs throughout the region, access to the Journal of Construction, reduced rates at all ASOCSA events, involvement at regional level with industry-academia forums, interaction and networking opportunities relative to, for example, collaborative research, curriculum development, external moderation of courses, and external examination

ASSOCIATION OF SCHOOLS OF CONSTRUCTION OF SOUTHERN AFRICA

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For more information on ASOCSA and its activities visit www.asocsa.org

TAX BENEFIT

ASOCSA is a registered Public Benefit Organization as defined in Section 30 of the Income Tax Act and a registered Section 21 Company as defined in the Companies Act. Therefore all donations made to ASOCSA will be fully deductible for income tax purposes and a section 18A certificate, for proof of deductibility will be issued to the donor upon receipt of the donation. The deductible donation is limited to 10% of the donors' taxable income before providing for Section 18A and Section 18 deductions.

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Introduction

THE CONSTRUCTION INDUSTRY DEVELOPMENT BOARD (CIDB)

The Construction Industry Development Board (cidb) of South Africa continues to show commitment towards the construction-related fields by sponsoring the 4th Built Environment Conference which convenes in Zambia between the 17th and 19th May 2009.

The Conference will bring together researchers, academics and business to discuss built environment: construction-related research, development and education from different parts of the world.

The 4th Built Environment Conference will discuss critical topics such as sustainable construction, education and professional development, service delivery, customer service, information technology, health and safety, and construction industry development amongst other important topics.

Support and commitment by cidb South Africa to the conference and the development of the industry at large is not only expressed through sponsorship but also through the keynote address to be delivered at the Conference by cidb's CEO Mr Ronnie Khoza and through a presentation of two papers titled "Changing the Tide in Infrastructure Delivery in Developing Countries" and "The State of Contractor Development".

The first paper focuses on Service Delivery / Customer Service by presenting an alternative delivery model of "supply chain" which aims to deliver infrastructure as well as other deliverables relating to poverty relief, enterprise development and training.

The second paper titled "The State of Contractor Development in South Africa", reports on qualitative and quantitative overview of the state of contractor development in the General Building and Civil Engineering sectors in South Africa –both papers give recommendations to the findings. "Our support to the international 4th Built Environment Conference is part of our effort and is in keeping with our motto-'development through partnership' to collaborate with various stakeholders and colleagues, locally and internationally towards contractor development.

In presenting the two papers we are encouraging industry role players to participate in writing and presenting good quality papers, thus developing and improving skills and sustainable delivery within the industry. " says Khoza.

The cidb was established in terms of the CIDB Act (Act 38) of 2000 to regulate and develop the construction industry for improved performance in infrastructure delivery and aims to provide leadership to stakeholders and to stimulate sustainable growth, reform and improvement of the construction sector for effective delivery and the industry's enhanced role in South Africa's economy.



About the University of Johannesburg

The University of Johannesburg (UJ), is the largest, multi-campus, residential universities in South Africa, seeks to achieve the highest distinction in scholarship and research within the higher education context.

Born from the merger between the former Rand Afrikaans University (RAU), the Technikon Witwatersrand (TWR) and the Soweto and the East Rand campuses of Vista University in 2005, the University of Johannesburg's **unique academic architecture** reflects a comprehensive range of learning programmes, leading to a variety of qualifications, from vocational and traditional academic to professional and postgraduate, across the **four campuses** –Auckland Park Kingsway, Auckland Park Bunting Road, Doornfontein and Soweto. The campuses vary in size and each has its own character and culture, contributing to the institution's rich diversity.

The University of Johannesburg has benefited from a large pool of researchers bringing together various fields of expertise and research focus areas. The university provides the ideal ground for interdisciplinary research and the university has more than **87 rated researchers**. Five of these researchers are A-rated - all of whom are recognised as world leaders in their field. The university is also home to nine **research centres**.

The University fosters ideas that are rooted in African epistemology, but also addresses the needs of South African society and the African continent as it is committed to contribute to sustainable growth and development. We continue to build a culture of inclusion, embracing South Africa's rich histories, cultures, languages, religions, genders, races, and social and economic classes. Additionally, the University encourages a culture of service as part of the university student experience and it proudly pursues a four-language policy of English, isiZulu, Afrikaans and Sesotho sa Leboa.

Our staff and students come from over 50 countries in Africa and around the world. The university has also built links, partnerships and exchange agreements with leading African and other international institutions that further enrich the academic, social and cultural diversity of campuses. It is also the recipient of the highest levels of external financial support, from donors and partners all over the world. This demonstrates the high esteem in which we are held internationally.

In its mission, UJ commits itself to the following:

- Quality education
- Leading, challenging, creating and exploring knowledge
- Supporting access to a wide spectrum of academic, vocational and technological teaching, learning and research
- Partnerships with our communities
- Contributing to national objectives regarding skills development and economic growth

The values guiding all University activities include:

- Academic distinction
- Integrity and respect for diversity and human dignity
- Academic freedom and accountability
- Individuality and collective effort
- Innovation

In giving expression to its vision of being a pre-eminent South African and African university UJ has set itself ten strategic goals. Its priorities are to:

- Build a reputable brand
- Promote excellence in teaching and learning
- Conduct internationally competitive research
- Be an engaged university
- Maximise its intellectual capital
- Ensure institutional efficiency and effectiveness
- Cultivate a culture of transformation
- Offer the preferred student experience
- Focus on the Gauteng city regions
- Secure and grow competitive resourcing



Introduction

CIB is the acronym of the abbreviated French (former) name: "Conseil International du Bâtiment" (in English this is: International Council for Building). In the course of 1998, the abbreviation has been kept but the full name changed into:

**INTERNATIONAL COUNCIL FOR RESEARCH AND INNOVATION IN
BUILDING AND CONSTRUCTION**

CIB was established in 1953 as an Association whose objectives were to stimulate and facilitate international cooperation and information exchange between governmental research institutes in the building and construction sector, with an emphasis on those institutes engaged in technical fields of research.

CIB has since developed into a world wide network of over 5000 experts from about 500 member organisations active in the research community, in industry or in education, who cooperate and exchange information in over 50 CIB Commissions covering all fields in building and construction related research and innovation.

CIB Members are institutes, companies and other types of organisations involved in research or in the transfer or application of research results. Member organisations appoint experts to participate in CIB Commissions. An individual also can be a member and participate in a Commission. CIB Commissions initiate projects for R&D and information exchange, organise meetings and produce publications. These meetings can be Commission meetings for members only or international symposia and congresses open to all. Publications can be proceedings, scientific or technical analyses and international state of the art reports.

CIB Past and Present

CIB was established in 1953 with the support of the United Nations, as an association whose objectives were to stimulate and facilitate international collaboration and information exchange between governmental research institutes in the building and construction sector. At that time an implicit objective also was to help rebuild the European infrastructure for building and construction research following the ravages of the second World War.

At the start 43 research institutes were members of CIB and by far the majority of these were European. And just as in the programmes of these institutes at that time, so in the CIB programme there was a strong emphasis on technical topics.

For selected topics CIB Commissions were established to which member organisations appointed experts from their staff to participate.

Along with all types of less visible activities, this collective participation resulted in many important international symposia and congresses and in a large number of publications acknowledged as of global standing. Indeed many of these formed the factual basis for developing international standards or were themselves used as such. Others were international state-of-the-art reports that for a long time provided an indispensable input to programming new research by the participating institutes and countries.

However, CIB has come a long way since 1953.

At present about 500 organisations are members of CIB from whom about 5000 individual experts participate in over 50 CIB Commissions. These extend over the whole area of building and construction research and innovation.

Amongst the CIB member organisations we can now find almost all the major national building research institutes in the world, as well as many other types of organisations in the building and construction sector who have joined us since. And although within the CIB programme considerable attention is still given to technical topics, there are now also activities focused on topics like organisation and management, economics of building, legal and procurement practices, architecture, urban planning and human aspects.

It is no exaggeration to say that at present CIB is the world's foremost platform for international cooperation and information exchange in the area of building and construction research and innovation. And we continue to increase our membership, to expand our scope, to initiate new activities while constantly striving to improve the quality of our products and services.

Association of Schools of Construction of Southern Africa

Association Incorporated in Terms of Section 21 Registration Number 2007/035311/08



31 July 2011

Dear Author

PEER REVIEW PROCESS: 6TH BUILT ENVIRONMENT CONFERENCE: DURBAN, SOUTH AFRICA 2011

I confirm that the following peer review process was strictly followed relative to this conference.

In order to maintain and ensure the highest quality in the conference proceedings and comply with the requirements for subsidy of the South African Department of Education, a rigorous two-stage system of peer review by no less than two acknowledged experts in the field has been followed. In terms of this process, each abstract received was twice blind reviewed in terms of:

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Regards

A handwritten signature in cursive script that reads "Ferial Lombardo". The signature is written in black ink and is positioned centrally below the "Regards" text.

Ms Ferial Lombardo
Conference Organizer

CONTENTS

Session 1A

Improving project delivery in South African Construction: Engineers' perspective <i>Fidelis Emuze & John Smallwood</i>	1
Lean Principles as a Strategic Option for Delivering Innovative Sustainable Construction Projects: A Client Value Driven Approach <i>Ayman Ahmed Ezzat Othman</i>	17
Perspectives for the implementation of Lean Construction in the Ghanaian Construction Industry <i>J. Ayarkwa, K. Agyekum and E. Adinyira</i>	37
Exploratory analysis of the relationship between transformational leadership of middle managers and project performance <i>John Kissi, Andrew Dainty and Martin Tuuli</i>	55
Barriers to Sustainable Implementation of Lean Construction in the Ghanaian Building Industry <i>J. Ayarkwa, K. Agyekum and E. Adinyira</i>	67
An analysis of the impact of rework on project performance: Views from the field <i>Eric Kwame Simpeh, Ruben Ndiokubwayo, Peter E.D. Love</i>	87
The exploration of human resource management (HRM) strategies implemented by architectural practices in order to achieve lean production (LP) <i>Sidloyi, X. and Smallwood J.J.</i>	100

Session 1 B

Identifying factors of health and safety (H&S) culture for the construction industry <i>Innocent Musonda, Theo Haupt</i>	112
Impact of rural migrant workers on construction health and safety (H&S) <i>Okorie NV and Smallwood JJ</i>	128
Critical indicators for measuring health and safety performance improvement in Small and Medium construction Enterprise projects <i>Justus N. Agumba; Theo Haupt</i>	143
Conceptual model of client centered health and safety performance improvement <i>Innocent Musonda & Theo C Haupt</i>	156

The influence of Quantity Surveyors on the construction industry's occupational health and safety <i>Niemandt, P-S. & Crafford, G. J</i>	168
Practitioners' perceptions of competencies possessed by quantity surveying graduates <i>Styan, J. and Crafford, G. J</i>	183
Impact of prefabrication on construction site health and safety: Perceptions of designers and contractors <i>L. Bikitsha and T. Haupt</i>	196

Session 1 C

Sustainable building awareness in the Free State Province, South Africa <i>Esti Jacobs</i>	215
Achieving Sustainability through Refurbishment of Tower Blocks: Tenants Perspective <i>Jamal M.Khatib, Nicholas Chileshe, and Farah Mohammed</i>	226
Water Conservation Technologies in South Africa's buildings <i>Aduda, K.O. and Ozumba, A.O.U</i>	241
The development of sustainable private retirement villages: establishment of residential preferences and development directives <i>Dries Hauptfleisch and Olive du Preez</i>	254
Attributes of Photovoltaic Energy Technology Perceptions of Ghanaian building industry Participants <i>Ashiboe-Mensah, N. A., Fugar, F.D.K and Adinyira, E</i>	268
The challenge of informal settlement statistics and impact on policy and planning in South Africa <i>Onatu GO, Mbinza Z</i>	279
An evaluation of indoor air quality (IAQ) for sustainable and healthy building practices in Kaduna, Nigeria <i>D. Abdulsalam, S. S. Aliyu, and M. Abdulrazaq</i>	293

Session 2 A

An assessment of risk management practices by consultants in Tanzania <i>G. J. Kikwasi</i>	302
Investigating Possible Communication Problems in the Building Team during the Construction Phase <i>Morulane, J.T. Ntsamaj, K.</i>	

<i>and Ozumba A.O.U.....</i>	<i>315</i>
Assessment of Maintenance Practices on Public Buildings: A case-study of correctional institutions <i>Farinloye O.O., Ogunsanmi O. E. and Adenuga A. O</i>	<i>333</i>
A Quantified Emerging Contractor Development Report: A Case Study in Pursuance of Best Practice <i>Sihle Dlungwana, Dries Hauptfleisch</i>	<i>348</i>
Modelling PhD (construction management) research findings: lessons from systems dynamics <i>Fidelis Emuze and John Smallwood.....</i>	<i>367</i>
Underlying Factors for Construction Research Collaboration in Ghana <i>Adinyira,E. and Fugar, F.D.K.....</i>	<i>385</i>

Session 2 B

Housing construction in the built environment: the case of urban growth in metropolitan Lagos <i>Aluko, O.....</i>	<i>402</i>
Community participation for housing development <i>Aigbavboa CO, Thwala WD.....</i>	<i>418</i>
Alleviating Housing Challenges in Nigeria <i>Richard Jimoh, Fidelis Emuze, John Smallwood and Jakobus van Wyk</i>	<i>431</i>
The effects of stringent lending criteria on residential property market <i>Gardner, P.J. and Slabber, J. M.....</i>	<i>445</i>
Building construction and the rental sub-sector: effects on housing delivery system in Nigeria <i>Aluko, O.....</i>	<i>459</i>
An analysis of the relationship between infrastructural facilities and residential property values in satellite towns of Abuja, Nigeria <i>Kemiki, O. A & Obiajulu-Nwokoye, C</i>	<i>472</i>

Session 2 C

An assessment of the needs of women-owned construction enterprises in South Africa for construction empowerment, development and sustainability (CODES) <i>Ferdinand C Fester, Ingrid Verwey, Theo C Haupt.....</i>	<i>483</i>
--	------------

Key performance indicators reflecting the condition of the construction industry	<i>Hendrik Jacobus Marx</i>	496
The use of community labour in South Africa construction	<i>Dane Langhein, Brink Botha, Fidelis Emuze</i>	510
Education and training in Alternate dispute resolution in a South African Context	<i>Du Preez, O.R.C & Vester JJP</i>	524
Culture Change in Construction: A Novel Approach for Achieving Lean Principles Objectives in Construction Projects	<i>Ayman Ahmed Ezzat Othman</i>	537
Improving the quality of life in low income residential neighbourhoods of Ibadan, Nigeria	<i>Adeniran, A.A., Elegbede, O.T. and Onakoya, B.O.</i>	556

Session 2 D

Timely project delivery: A case study of Malawian educational infrastructure projects	<i>Chirwa, D., Samwinga, V. and Shakantu, W.</i>	567
Assessment of emotional intelligence training provided to junior project managers in the construction industry	<i>Wiese</i>	585
Application of Fast-Tracking Practices on Construction Projects – Evidence from South Australia	<i>Rabia Nassereddine and Nicholas Chileshe</i>	596
The Practice of Out-sourcing in the Management of Office Building/Facilities in Lagos-Nigeria	<i>H. A. Koleoso, R.O. A. Iyagba and O. E. Ogunsanmi</i>	611
Comments from the Property Industry on Masters Real Estate Curricula in South Africa	<i>S.H.P. Chikafalimani, W. D. Thwala, C. E. Cloete</i>	626

ASOCSA2011-01

Improving Project Delivery in South African Construction: Engineers' perspectives

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ABSTRACT

Purpose: Project performance improvement initiatives are continually demonstrated through case studies and empirical results documented in international construction management literature. The volume of these publications is not unconnected with the need to improve construction project delivery holistically. Therefore, this study was embarked upon in order to identify performance impediments and possible remedies in South Africa.

Design / Methodology / Approach: A quantitative survey, which relied upon secondary data identified in related literature, was undertaken among consulting engineers whose organisations are members of Consulting Engineers South Africa (CESA).

Findings: Poor information management that may lead to inability to tackle risks / uncertainties effectively; poor analysis of issues and their impact, which may result in inadequate site relationship management; inadequate knowledge relative to nature of work that may lead to ineffective H&S monitoring and inspection; poor work procedures / methods that may eventually lead to defects and rework; have continue to marginalise project performance improvement unabatedly.

Practical implications: The noted performance gaps necessitate a radical shift in the way stakeholders manage the construction process, that is, engendering a system that encourages continuous improvement is desirable in the South African construction context.

Originality / Value: While not the least performing in the developing world, construction project delivery in South Africa is reportedly facing a number of impediments, which are not insurmountable if these impediments are identified, and necessary interventions engendered in the construction process.

KEYWORDS: Construction, Consultants, Infrastructure, Performance, South Africa

1. INTRODUCTION

The construction process starts with a client's decision to procure a facility or infrastructure in order to satisfy a particular need. The need may be profit oriented or as in the case of the public sector, the need may be socially oriented. For instance, the quest for an improved standard of living in a society is aided by infrastructure. Infrastructure that requires huge capital outlay is commonly financed by the public sector and in some cases, when the private sector is given enough incentive, private funds can be used. However, before the infrastructure is put to use at the operational phase, it must be built by participants of the construction supply chain. The principal member of the supply chain is the client that normally decides the procurement route that will be used for the provision of the infrastructure. Timely provision of quality infrastructure by the public sector therefore depends on the procurement system adopted for construction. The procurement system in turn impacts on the organisational, financial and administrative structure of the project, and also could contribute crucially to its success or failure (Walker and Greenwood, 2002).

In fact within the construction sector, procurement refers not only to what is bought, but also to a diverse array of methods for acquiring a huge range of immovable assets (Hughes et al., 2006). In addition, the process of selecting competent suppliers is known as the process of procurement (Winch, 2010). These definitions suggest that the way in which clients, designers, contractors, and suppliers work together as a team is determined by the procurement strategy and the forms of contract entered into between project participants and the clients (Morledge, 2002).

Therefore, procurement systems have important implications for the way project risks can be allocated among project participants, management of the risks, and the strategies for getting the required value in terms of major project variables (Walker and Greenwood, 2002). The implication is that in order to optimise construction performance, it is vital to understand all aspects of procurement (Tookey *et al.*, 2002). However, empirical research findings suggest that a range of impediments marginalise the realisation of project objectives, and by implication hinder project performance improvement in construction (Flyvberg *et al.*, 2003; Love *et al.*, 2008).

2. PROJECT PERFORMANCE IMPEDIMENTS IN CONSTRUCTION

The performance of projects in South African construction as indicated in the Construction Industry Development Board (cidb) annual Construction

Industry Indicators (CII) in the recent past suggest that there is enough scope for performance improvement in the industry. In particular, the CII that measures performance in terms of client satisfaction; contractor satisfaction; profitability and payment delays; procurement indicators; and health and safety have continued to, *inter-alia*, call for improvement relative to contractors' project performance, quality of work delivered during project implementation, defects which are regarded as inappropriate, quality of tender documents and specifications used for project execution, and the management of variation orders (cidb, 2008; cidb, 2009a; cidb, 2010).

Focusing on performance improvement therefore requires looking at events / processes that contributes to project realisation. For instance, decision making at project inception is crucial because it impacts the project delivery outcome. Clients' decisions affect the responsibilities of the project parties; influence the control of design, construction, and project commissioning. Risk management is about predicting the future by making decisions in a systematic manner. Decisions are made against a predetermined set of objectives, rules / or priorities based upon knowledge, data, and information relevant to the issue (Smith *et al.*, 2006). Unfortunately, clients do not make their decisions following this process. Research indicates that clients and their advisors select procurement systems in an illogical and inappropriate manner (Masterman, 1992 cited by Tookey *et al.*, 2002). That is, decisions are often ill-founded and are not based on a logical assessment of project-specific criteria despite the industry wide knowledge that risk does not always refer to the occurrence of bad consequences, but also the possibility of opportunities. Smith *et al.* (2006) contend that risks exists when a decision is expressed in terms of a range of possible outcomes, and when known probabilities can be attached to the outcomes; and uncertainty exists when there is more than one possible outcome of a course of action but the probability of each outcome is not known.

Another relevant issue in this context is the ability to create, document, and transfer project related knowledge in order to avoid repeating past mistakes. Knowledge management (KM) can be viewed as a systematic process of discovering, choosing, arranging, refining and presenting information in such a way that it improves an employee's comprehension in a specific area of interest (Sommerville and Craig, 2006). Prior research indicates that design, architecture, surveying, and other construction services are knowledge-intensive service sectors (Egbu and Robinson, 2005) so much so that Fernie *et al.* (2003 cited by Sommerville and Craig, 2006) opine that within an organisation, KM can be said to have the same degree of importance as labour, plant, and materials. However, because project knowledge is domiciled in different firms within the construction supply chain, a key aspect of KM is the transfer or sharing of knowledge for the benefit of the project since many innovation processes in the management and procurement of construction activities are distributed within organisations and across organisational boundaries (Egbu and Robinson, 2005). Without doubt, organisations working together in construction supply chains are likely to spread and share best practice or spread and / or repeat past mistakes depend on the importance attached to knowledge management in the project set-up.

The present nature and structure of the industry indicate that many processes are replicated resulting in waste and inefficiencies within the supply chain. In order for the industry to improve its performance the

industry needs to change its prevailing culture, and by implication, supply chain member firms needs to change their culture towards a culture that support continuous improvement. This culture will not only allow information sharing between projects, teams, and organisational boundaries, but will also support the construction sector in adopting new / or innovative processes, which improves quality and productivity (Sommerville and Craig, 2006). In this sense, culture in construction project scenarios is the culture of the project team comprising different contracting entities in the supply chain and also includes company-wide inter-departmental members and others who contribute in some way to the final product or service to be delivered (Mackay, 1993 cited by Rahman *et al.*, 2002).

Other notable project performance improvement impediments in South African construction include H&S (cidb, 2009b) and quality (cidb, 2010). Specifically, the cidb report *Construction Health and Safety in South Africa Status & Recommendations* contend that overall, construction H&S is not improving commensurately as the construction industry continues to contribute a disproportionate number of fatalities and injuries relative to other industrial sectors in the country. In addition, though the cidb (2009c) standard for uniformity in construction procurement (SFU) refers to quality as functionality, problems evident in low cost housing construction is so mindboggling that it could be assumed that the quality criterion may not be given priority when appointing project partners.

To be succinct, these project performance impediments warrant further investigation so as to highlight the pertinent issues that must be addressed, and also find a way forward in the South African construction context.

3. THE RESEARCH

The related literature surveyed invariably led to a larger empirical study in which only the findings that emanated from consulting engineers that are members of CESA are reported upon in this paper. The mixed-mode quantitative survey was used to elicit information from the respondents through a structured questionnaire that, *inter-alia*, requested for information relative to project performance impediments in South African construction. It is notable that 28 of the 56 consulting engineering firms surveyed, responded, which equates to a response rate of 50.0%.

The likert-scale type questions are discussed based on mean score comparison, and where appropriate percentages were used in the discussion. Specifically, percentage discussions revolved around terms listed in Table 1.1, while the terms used for discussions relative to the likert-scale type questions are indicated in Table 1.2. The ranges in Table 1.2 are computed based on the fact that all the likert-scale type questions used in the research were to a five-point likert-scale. Therefore, the difference between the upper and lower ends of the used scale is 4.0 since there are five points. Hence, each range can be equated to 0.80 because the extent of the range is determined by a division between 4.00 and 5 (4/5).

Table 1.1 Terms used to discuss percentage ranges

Range	Meaning
100%	All
$\geq 80\% < 100\%$	Most
$\geq 66.7\% < 80\%$	Majority
$\geq 50\% \leq 66.6\%$	More than half
50%	Half
$\geq 33.4\% < 50\%$	Less than half
$\leq 33.3\%$	Minority

Table 1.2 Terms used to discuss mean score comparison

Mean score range	Meaning
$> 4.20 \leq 5.00$	Near major extent to major extent Agree to strongly agree
$> 3.40 \leq 4.20$	Some extent to near major extent Neutral to agree
$> 2.60 \leq 3.40$	Near minor extent to some extent Neutral / Neutral
$> 1.80 \leq 2.60$	Minor to near minor extent Disagree to Neutral
$> 1.00 \leq 1.80$	Less than minor to a minor extent Strongly disagree to disagree

3.1 RESULTS AND DISCUSSION

In addition, as indicated in Table 1.3 and Table 1.4, 67.9% of the respondents have participated in a range of infrastructure projects that involved road construction and other non-residential construction, while construction management (78.6%), design by employer (60.7%), and design and build (57.1%) constitute the predominating type of contract the respondents have used in the recent past.

Table 1.3 Types of infrastructure projects undertaken by respondents

Project category	Yes (%)
Transport (roads, port, harbour)	67.9
Water (storm water, treatment plant)	64.3
Other non-residential construction	67.9

Table 1.4 Types of contract used for infrastructure projects

Type	Yes (%)
Construction Management	78.6
Design and Build	57.1
Design by Employer (traditional)	60.7
Management Contracting	32.1
Public Private Partnerships (PPP)	35.7

Furthermore, Table 1.5 indicates that a significant number of the respondents (75.0%) have undertaken and / or participated in over twenty construction projects since their entry into the industry; Figure 1.1 indicate that a significant number of the respondents have over twenty years of construction industry experience (67.9%); and Figure 1.2 indicates that the majority of respondents possess BTech / BSc (Hon) qualifications (67.9%).

Table 1.5 Number of projects respondents have undertaken in the industry

Range	≤ 5	6 – 10	11 – 15	16 – 20	> 20
Yes (%)	3.6	10.7	3.6	7.1	75.0

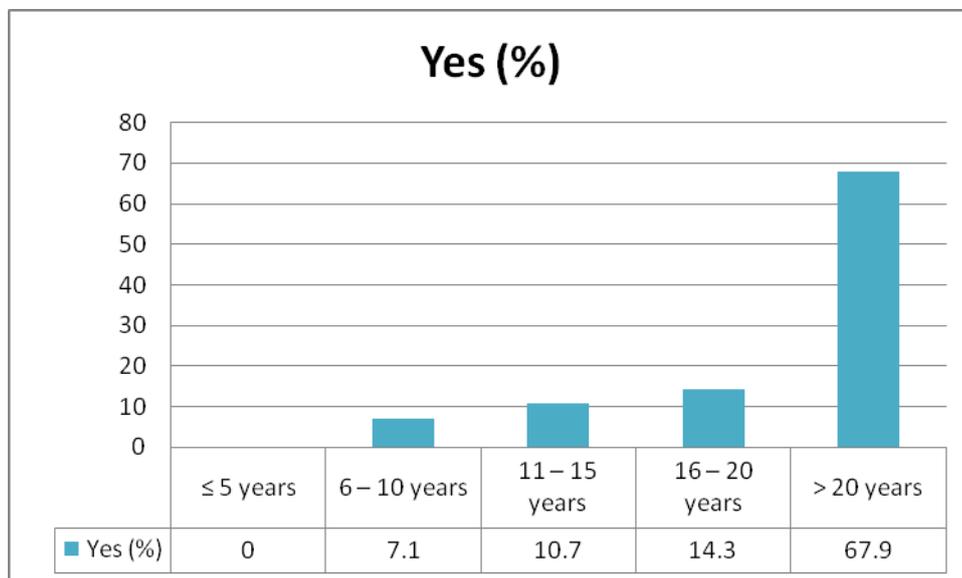


Figure 1.1 Length of South African construction industry experience

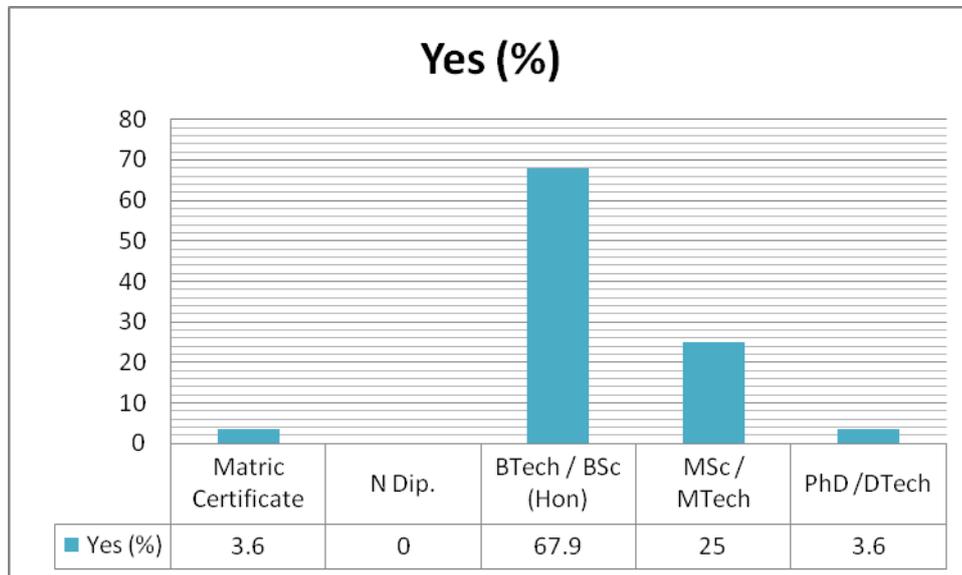


Figure 1.2 Highest formal education achieved by respondents

This suggests that the respondents may be deemed experienced and knowledgeable enough to express valid perceptions relative to construction performance related problems, and also proffer possible remedies that are suitable and relevant in the South African construction industry context.

Table 1.6 indicates the respondents' perceptions of the extent that listed practices / situations contribute to inadequate documentation and transfer of knowledge in construction in terms of percentage responses to a scale of 1 (minor) to 5 (major), and a mean score (MS) ranging between 1.00 and 5.00. It is notable that all the listed practices have MSs above the midpoint of 3.00, which suggests that the respondents deem the practices / situations to contribute more of a major than a minor extent to inadequate documentation and transfer of knowledge in South African construction.

Therefore, it can be assumed that the respondents perceive poor information management, lack of mentorship programmes, lack of post project reviews / reports, and lack of detailed databases relative to past projects to be deemed to contribute between some extent to a near major extent (MSs $> 3.40 \leq 4.20$), while poor allocation of resources to knowledge capture with a MS $> 2.60 \leq 3.40$ may be deemed to contribute between a near minor extent to some extent to inadequate documentation and transfer of knowledge in South African construction.

Table 1.6 Practices contributing to inadequate documentation and transfer of knowledge in construction

Practices / Situations	Response (%)			MS	Rank
	Unsure	Minor	Major		

Proceedings 6th Built Environment Conference
 Improving Project Delivery in South African Construction:
 Engineers' perspectives

31 July -2 August 2011
 JHB, South Africa
 ISBN:978-0-86970-713-5

		1	2	3	4	5		
Poor information management	0.0	7.1	7.1	25.0	39.3	21.4	3.61	1
Lack of mentorship programmes	3.6	7.1	7.1	14.3	57.1	10.7	3.59	2
Lack of post project reviews / reports	3.6	10.7	7.1	17.9	39.3	21.4	3.56	3
Lack of detailed databases relative to past projects	0.0	7.1	14.3	17.9	42.9	17.9	3.50	4
Poor allocation of resources to knowledge capture	10.7	10.7	7.1	28.6	28.6	14.3	3.32	5

Table 1.7 indicates the respondents' perceptions of the extent that listed practices / situations occurs as a result of inadequate documentation and transfer of knowledge in construction in terms of percentage responses to a scale of 1 (strongly disagree) to 5 (strongly agree), and a mean score (MS) ranging between 1.00 and 5.00. It is notable that all the respondents can be deemed to agree with all listed consequences of inadequate documentation and transfer of knowledge in South African construction as all recorded MSs are above the midpoint of 3.00.

MSs $> 3.40 \leq 4.20$ suggest that the respondents' concurrence can be deemed to be between neutral to agree that inability to tackle risks / uncertainties effectively, inability to innovate and respond to clients' needs, lost opportunities to improve project performance, inability to disseminate 'best practices', ineffective problem solving capabilities, and poor response to organisational and project changes occurs in construction due to inadequate documentation and transfer of knowledge in South African construction, while the respondents' concurrence can be deemed to be neutral that repetition of past project mistakes and the loss of contractor, subcontractor / supplier track record occurs due to inadequate documentation and transfer of knowledge (MS $> 2.60 \leq 3.40$).

Table 1.7 Consequences of lack of proper documentation and transfer of knowledge in construction

Situation	Response (%)						MS	Rank
	Unsure	Strongly disagree.....	Strongly agree	1	2	3		
Inability to tackle risks / uncertainties effectively	3.6	7.1	10.7	7.1	46.4	25.0	3.74	1
Inability to innovate and respond to clients' needs	3.6	10.7	17.9	7.1	32.1	28.6	3.52	2
Lost opportunities to improve project performance	0.0	7.1	14.3	21.4	35.7	21.4	3.50	3
Inability to disseminate 'best practices'	0.0	10.7	7.1	28.6	28.6	25.0	3.50	4
Ineffective problem solving capabilities	0.0	7.1	17.9	17.9	35.7	21.4	3.46	5
Poor response to organisational and project changes	7.1	7.1	17.9	17.9	25.0	25.0	3.46	6
Repetition of past project mistakes	0.0	14.3	7.1	28.6	25.0	25.0	3.39	7
Loss of contractor, subcontractor / supplier track record	7.1	10.7	7.1	32.1	28.6	14.3	3.31	8

Table 1.8 indicates the respondents' perceptions of the extent that listed practices / situations contribute to inappropriate organisational culture in construction in terms of percentage responses to a scale of 1 (minor) to 5 (major), and a mean score (MS) ranging between 1.00 and 5.00. It is notable that all the listed practices have MSs above the midpoint of 3.00, which suggests that the respondents deem them to contribute more of a major than a minor extent to inappropriate organisational culture in South African construction.

As a result, it can be assumed that the respondents perceive that poor analysis of issues and their impact, closed one-directional communication mediums, lack of trust within project teams, improper worker motivation and empowerment, apathy toward idea generation and evaluation, non-inclusive decision-making within project teams with MS $> 2.60 \leq 3.40$ may be deemed to contribute between a near minor extent to

some extent to inappropriate organisational culture in South African construction.

Table1. 8 Practices contributing to inappropriate organisational culture in construction

Practices	Response (%)						MS	Rank
	Unsure	Minor.....	Major					
		1	2	3	4	5		
Poor analysis of issues and their impact	10.7	7.1	14.3	17.9	39.3	10.7	3.36	1
Closed one-directional communication mediums	14.3	10.7	10.7	25.0	21.4	17.9	3.29	2
Lack of trust within project teams	3.6	10.7	21.4	17.9	28.6	17.9	3.22	3
Improper worker motivation and empowerment	7.1	14.3	10.7	28.6	28.6	10.7	3.12	4
Apathy toward idea generation and evaluation	14.3	14.3	14.3	21.4	21.4	14.3	3.08	5
Non-inclusive decision-making within project teams	10.7	14.3	17.9	21.4	21.4	14.3	3.04	6

Table 1.9 indicates the respondents' perceptions of the extent that listed practices / situations occur as a result of inappropriate organisational culture in construction in terms of percentage responses to a scale of 1 (strongly disagree) to 5 (strongly agree), and a mean score (MS) ranging between 1.00 and 5.00. It is notable that all the respondents can be deemed to agree with all listed consequences of inappropriate organisational culture in South African construction as all recorded MSs are above the midpoint of 3.00.

MSs $> 3.40 \leq 4.20$ suggest that the respondents' concurrence can be deemed to be between neutral to agree in terms of the occurrence of inadequate site relationship management and organisational stagnation / failure in South African construction due to inappropriate organisational culture, while the MSs $> 2.60 \leq 3.40$ indicate that the respondents' concurrence relative to poor problem identification and resolution, poor harnessing of skills within project teams, employee dissatisfaction, poor customer / client dissatisfaction, poor handling of social issues associated with projects, and increased resistance to change can be deemed to be neutral.

Table 1.9 Consequences of inappropriate organisational culture in construction

Situations	Response (%)						MS	Rank
	Unsure	Strongly disagree.....	Strongly agree					
		1	2	3	4	5		
Inadequate site relationship management	10.7	7.1	14.3	21.4	25.0	21.4	3.44	1
Organisational stagnation / failure	14.3	10.7	7.1	21.4	28.6	17.9	3.42	2
Poor problem identification and resolution	7.1	10.7	14.3	17.9	32.1	17.9	3.35	3
Poor harnessing of skills within project teams	10.7	10.7	17.9	14.3	25.0	21.4	3.32	4
Employee dissatisfaction	14.3	3.6	25.0	14.3	28.6	14.3	3.29	5
Poor handling of social issues associated with projects	7.1	7.1	25.0	14.3	28.6	17.9	3.27	6
Customer / Client dissatisfaction	14.3	3.6	21.4	25.0	25.0	10.7	3.21	7
Increased resistance to change	10.7	14.3	7.1	25.0	32.1	10.7	3.20	8

Table 1.10 indicates the respondents' perceptions of the extent that listed practices / situations contribute to unacceptable coordination and regard for H&S in construction in terms of percentage responses to a scale of 1 (minor) to 5 (major), and a mean score (MS) ranging between 1.00 and 5.00. It is notable that all the listed practices have MSs above the midpoint of 3.00, which suggests that the respondents deem them to contribute more

of a major than a minor extent to unacceptable coordination and regard for H&S in construction in South African construction.

Consequently, it can be assumed that the MSs $> 3.40 \leq 4.20$ indicate that the respondents perceive practices such as inadequate knowledge relative to nature of work and collective organisation values relative to H&S to be deemed to contribute between some extent to a near major extent to unacceptable coordination and regard for H&S in South African construction, while H&S competence of project participants, poor comprehension of project characteristics, and H&S management procedures / systems with $MS > 2.60 \leq 3.40$ may be deemed to contribute between a near minor extent to some extent to unacceptable coordination and regard for H&S in South African construction.

Table 1.10 Practices contributing to unacceptable coordination and regard for H&S in construction

Practices	Response (%)						MS	Rank
	Unsure	Minor.....		Major				
		1	2	3	4	5		
Inadequate knowledge relative to nature of work	3.6	7.1	7.1	21.4	42.9	17.9	3.59	1
Collective organisation values relative to H&S	7.1	7.1	14.3	17.9	42.9	10.7	3.38	2
H&S competence of project participants	0.0	10.7	17.9	14.3	42.9	14.3	3.32	3
Poor comprehension of project characteristics	7.1	7.1	14.3	35.7	21.4	14.3	3.23	4
H&S management procedures / systems	0.0	17.9	17.9	21.4	25.0	17.9	3.07	5

Table 1.11 indicates the respondents' concurrence relative to the extent that listed practices / situations occur as a result of unacceptable coordination and regard for H&S in construction in terms of percentage responses to a scale of 1 (strongly disagree) to 5 (strongly agree), and a mean score (MS) ranging between 1.00 and 5.00. It is notable that not all the respondents can be deemed to agree with all listed consequences of unacceptable coordination and regard for H&S in South African construction as one of the five MSs is below the midpoint of 3.00.

However, a notable observation is that all recorded MSs are $> 2.60 \leq 3.40$, which indicates that the respondents' concurrence relative to ineffective H&S monitoring and inspection, poor status of H&S within the construction process, lack of project specific H&S specification, lack of project specific H&S plan, and work stoppages, injuries, and fatalities can be deemed to be neutral.

Table 1.11 Consequences of unacceptable coordination and regard for H&S in construction

Situation	Response (%)						MS	Rank
	Unsure	Strongly disagree.....		Strongly agree				
		1	2	3	4	5		
Ineffective H&S monitoring and inspection	3.6	14.3	21.4	3.6	35.7	21.4	3.30	1
Poor status of H&S within the construction process	3.6	17.9	25.0	10.7	21.4	21.4	3.04	2
Lack of project specific H&S specification	0.0	10.7	32.1	14.3	32.1	10.7	3.00	3
Lack of project specific H&S plan	0.0	10.7	28.6	21.4	28.6	10.7	3.00	4
Work stoppages, injuries, and fatalities	3.6	21.4	21.4	25.0	10.7	17.9	2.81	5

Table 1.12 indicates the respondents' perception of the extent that listed practices / situations contribute to inadequate management of quality in construction in terms of percentage responses to a scale of 1 (minor) to 5

(major), and a mean score (MS) ranging between 1.00 and 5.00. It is notable that all the listed practices have MSs above the midpoint of 3.00, which suggests that the respondents deem them to contribute more of a major than a minor extent to inadequate management of quality in South African construction.

Thus, it can be assumed that the MSs $> 3.40 \leq 4.20$ indicate that the respondents perceive practices such as poor work procedures / methods and poor understanding of quality to be deemed to contribute between some extent to a near major extent to inadequate management of quality in South African construction, while poor project specifications, poor project cost and schedule data as well as poor exchange of project information with MSs $> 2.60 \leq 3.40$ can be deemed to contribute between a near minor extent to some extent to inadequate management of quality in South African construction.

Table 1.12 Practices contributing to inadequate management of quality in construction

Practices / Situations	Response (%)						MS	Rank
	Unsure	Minor	Major					
		1	2	3	4	5		
Poor work procedures / methods	0.0	7.1	3.6	32.1	28.6	28.6	3.68	1
Poor understanding of quality	0.0	14.3	7.1	14.3	35.7	28.6	3.57	2
Poor project specifications	0.0	14.3	17.9	10.7	32.1	25.0	3.36	3
Poor project cost and schedule data	3.6	14.3	17.9	14.3	32.1	17.9	3.22	4
Poor exchange of project information	0.0	17.9	10.7	28.6	28.6	14.3	3.11	5

Table 1.13 indicates the respondents' concurrence relative to the extent that listed practices / situations occur as a result of inadequate management of quality in construction in terms of percentage responses to a scale of 1 (strongly disagree) to 5 (strongly agree), and a mean score (MS) ranging between 1.00 and 5.00. It is notable that not all the respondents can be deemed to concur with all the listed consequences of inadequate management of quality in South African construction as one of the five MSs are below the midpoint of 3.00.

However, it is notable that three MSs are $> 3.40 \leq 4.20$, which indicates that the respondents' concurrence can be deemed to be between neutral to agree in terms of the occurrence of defects and rework, increased project duration and cost, and client dissatisfaction in South African construction due to inadequate management of quality, while MSs $> 2.60 \leq 3.40$ indicate that the respondents' concurrence relative to high built asset maintenance cost as well as injuries and fatalities can be deemed to be between disagree to neutral.

Table 1.13 Consequences of inadequate management of quality in construction

Situations	Response (%)						MS	Rank
	Unsure	Strongly disagree.....Strongly agree						
		1	2	3	4	5		
Defects and rework	0.0	3.6	3.6	21.4	39.3	32.1	3.93	1
Increased project duration and cost	3.7	3.7	11.1	14.8	40.7	25.9	3.77	2
Client dissatisfaction	3.6	10.7	10.7	25.0	25.0	25.0	3.44	3
High built asset maintenance cost	7.1	14.3	14.3	25.0	25.0	14.3	3.12	4
Injuries and fatalities	3.6	14.3	35.7	17.9	17.9	10.7	2.74	5

Table 1.14 indicates the respondents' perceptions of the extent that listed perspectives / practices / interventions contribute to project performance improvement in construction in terms of percentage responses to a scale of 1 (minor) to 5 (major), and a mean score (MS) ranging between 1.00 and 5.00. It is notable that all the listed perspectives / practices / interventions have MSs above the midpoint of 3.00, which suggests that the respondents deem them to contribute more of a major than a minor extent to project performance improvement in South African construction.

Therefore, since all the MSs are $> 3.40 \leq 4.20$, the respondents can be deemed to perceive that adequate documentation and transfer of knowledge; appropriate allocation of project risk; continuous human resources development; good organisational culture among project partners; Total Quality Management of all processes; reliable and efficient logistics management practices; robust open information sharing among project team, and integrative H&S management can to be deemed to contribute between some extent to a near major extent to project performance improvement in South African construction.

Table 1.14 Interventions contributing to project performance improvement in construction

Perspectives / Practices / Interventions	Response (%)						MS	Rank
	Unsure	Minor.....Major				5		
		1	2	3	4			
Adequate documentation and transfer of knowledge	3.6	3.6	0.0	7.1	50.0	35.7	4.19	1
Appropriate allocation of project risk	3.6	0.0	7.1	21.4	21.4	46.4	4.11	2
Continuous human resources development	3.6	3.6	0.0	17.9	35.7	39.3	4.11	3
Good organisational culture among project partners	3.6	0.0	0.0	21.4	46.4	28.6	4.07	4
Total Quality Management of all processes	0.0	3.6	3.6	17.9	35.7	39.3	4.04	5
Reliable and efficient logistics management practices	3.6	0.0	3.6	28.6	35.7	28.6	3.93	6
Robust open information sharing among project team	3.6	3.6	0.0	25.0	39.3	28.6	3.93	7
Integrative H&S management practices	0.0	3.6	14.3	21.4	32.1	28.6	3.68	8

4. CONCLUSION

In general, it is apparent from the research findings that construction project performance impediments exist in South Africa construction; these impediments lead to range of consequences that portend unpalatable news for project stakeholders, and a range of interventions are robust enough to be valuable in the industry.

Specifically, issues relative to poor information management, lack of mentorship programmes, lack of post project reviews / reports, and lack of detailed databases relative to past projects; inability to tackle risks / uncertainties effectively, inability to innovate and respond to clients' needs, lost opportunities to improve project performance, inability to disseminate 'best practices'; inadequate knowledge relative to nature of work in terms of the H&S requirements of the work; poor work procedures / methods and poor understanding of quality in the construction process which invariably lead to defects, rework, and increased project duration and cost in project procurement must be addressed in order to engender project performance improvement in the industry.

Based on the perceptions expressed in the responses to the research, it is recommended that project stakeholders that are interested in

project performance improvement should endeavour to focus on issues such as adequate recordation and transfer of knowledge (tacit and explicit); appropriate allocation of project risk; continuous human resources development in the light of the much talked about skills shortage challenges; good organisational culture among project partners, especially between critical construction supply chain members such as clients, designers, and contractors; and Total Quality Management of all processes so as to avoid rework and adopt the 'get it right first time' approach by all involved in project conception and implementation.

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Lean Principles as a Strategic Option for Delivering Innovative Sustainable Construction Projects: A Client Value Driven Approach

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ABSTRACT

Purpose of this paper: Construction has been viewed by researchers as being slow progressing industry with recurrent problems such as low productivity, insufficient quality, time and cost overruns as well as poor safety which hinders client's delivered value. Towards overcoming these problems, innovative and unconventional solutions are sought. This paper aims to investigate the role of lean principles in delivering innovative sustainable construction projects that add values to their clients.

Methodology: In order to achieve the abovementioned aim, four objectives have to be accomplished. Firstly, conducting a comprehensive literature review to investigate the topics of lean principles, concept of value, client value system, lean principles for innovation and sustainability and barriers to implement lean principles. Secondly, presenting a number of case studies of innovative sustainable construction projects benefited from applying the lean principles. Thirdly, developing a framework to facilitate the integration of lean principles in design and construction organisations as an approach for developing innovative sustainable construction projects. Finally, summarising research conclusions and recommendations useful to decision makers and construction professionals.

Findings: Lean principles are strategic for developing innovative sustainable construction projects that deliver optimum values to their clients. The lean principles have to be integrated within the design and construction activities, and hence frameworks for facilitating the integration process have to be developed.

Research implications: This research promotes learning from other industries such as manufacturing to improve the performance of the construction industry through delivering value added sustainable

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construction projects.

Practical implications: The adoption of the framework developed by this research will facilitate the integration of lean principles in design and construction firms and assist in developing innovative sustainable projects that add values to their clients.

Value: This research adds valuable contribution the original body of knowledge through integrating lean principles within the design and construction activities as a strategic option for delivering value added innovative sustainable construction projects.

Keywords: Lean Principles, Innovation, Sustainability, Design and Construction activities, Construction projects.

1 INTRODUCTION

The increasing recognition of clients as the core of the construction industry and a vital driving force for improvement necessitated the importance of achieving their satisfaction (Latham, 1994; Egan, 1998; Othman, 2004). Clients are most likely to be satisfied when they are supplied with projects that achieve their objectives, meet their expectations and provide them with best value for money (Barrett and Stanley, 1999; Watson and Asher, 1999; Othman, 2007). To achieve these objectives, a number of tools, techniques and strategies have been developed over the years such as value management, risk management, total quality management, integrating clients in the decision-making process, constructability and partnership. In spite of the valuable contributions of these approaches, sophisticated client requirements and project complexity in terms of innovation and sustainability, called for learning from other industries such as manufacturing which showed successful improvement in performance through eliminating waste and adding value (Koskela, 1992; Latham, 1994; Egan, 1998; Othman, 2010). Towards delivering innovative sustainable projects that achieve best value for money, lean principles have to be applied throughout the project life cycle and as early as possible. Adopting the lean principles is expected to bring a dramatic change to the way of work in every industry. Emmitt et al. (2004) stated that keen contracting companies have adopted lean principles relatively quickly to reduce waste and add better value in their construction projects. Although only a small fraction of improvement is observed in manufacturing, the incentive to apply these concepts in construction would be tremendous. This paper aims to investigate the role of adopting lean principles as a strategic option for delivering best value innovative sustainable construction projects. A research methodology is designed to achieve the abovementioned aim. Firstly, literature review is used to build a comprehensive background about lean principles, concept of value, client value system, lean principles for innovation and sustainability and barriers to implement lean principles. Secondly, case studies of innovative sustainable construction projects benefited from applying lean principles are presented. Thirdly, a framework to facilitate the integration of lean

principles in design and construction firms as an approach for delivering best value innovative sustainable construction projects is developed. Finally, research conclusions and recommendations for decision makers and construction professionals are outlined.

2 LITERATURE REVIEW

2.1 Lean Principles

By referring to Oxford dictionary (2010), "Lean" means thin, lack in richness and quantity, economical, sharp and low content. The main idea beyond lean concept is to maximize client's delivered value while minimizing waste. Simply, lean means creating more value for clients with fewer resources. Organisations that adopt the lean concept define client's value and develop all the plans and processes needed to achieve and continuously increase it. The optimum goal of lean organisations is to focus on the most effective means of producing value for their clients. Lean organisations approach these challenges by applying 5 basic lean principles of:

- a) Specifying client's value through precise understanding and identification of client wants and only what the client wants.
- b) Understanding the value stream, which are the activities that, when done correctly and in the right order, produce the product or service that the client values. Activities can be classified as (1) unnecessary and wasteful activities (should be eliminated); (2) supporting the value-adding activities (should be reduced as far as possible); and (3) client value-adding (should be continuously improved).
- c) Improving the flow of work to be steady and without interruption from one value adding or supporting activity to the next. Flow significantly speeds the processing and every effort should be made to eliminate obstacles and bottlenecks that prevent flow.
- d) Adopting the pull strategy to react to client demand. In non-lean organisations work is pushed, in other words, the system produces outputs that are not required. Most lean services react to client demand and so pull the work through the system.
- e) Perfection – based on the implementation of the four principles mentioned above, organisations should understand the system ever better and generate ideas for more improvement. A perfect process delivers just the right amount of value to the client. In a perfect process, every step is valuable-adding, capable (produces a good result every time), available (produces the desired output, not just the desired quality, every time), adequate (does not cause delay), flexible, and linked by continuous flow. If one of these factors fails some waste is produced.

2.2 Lean for Production and Services

A popular misconception is that lean is used only for manufacturing. In fact, lean principles apply in every business and process. Lean is not a tactic or

a cost reduction exercise, but a way of thinking and acting for an entire organization. Businesses in all industries and services are using lean principles as the way they think and do. Many organisations choose not to use the word lean, but to label what they do as their own system, such as the Toyota Production System or the Danaher Business System. This is to drive home the point that lean is not a programme or short term cost reduction exercise, but the way the company operates. The word transformation or lean transformation is often used to characterize a company moving from an old way of thinking to lean thinking (Lean Enterprise Institute, 2010; Womack and Jones, 2003).

2.3 Lean Delivering Methods

The most commonly methods used to implement lean principles are:

2.3.1 Overall Lean Frameworks

- a) **Kaizen Rapid Process Improvement Events**
Kaizen is a Japanese word means (change for the better) refers to the continuous, incremental improvement of production activities. It is typically implemented through frequent, structured worker-oriented events that last 3-7 days.
- b) **Value Stream Mapping**
A process mapping method used to document the current and future states of the information and material flows in a value stream from client to supplier. Lean practitioners use value-stream maps to identify targets for future process improvement activities (e.g., *kaizen* events).

2.3.2 Process Improvement Methods

- a) **5S - An improvement process involving five steps (Sort, Set in order, Shine, Standardize, and Sustain) to create and maintain a clean, neat, and orderly workplace.** Some organisations add a sixth "S" for Safety.
- b) **Standard Work & Visual Controls**
Standard work represents the best (least-waste) way to perform a given operation. Visual controls are used to reinforce standardized procedures and to display the status of an activity so every employee can see it and take appropriate action.

- c) Cellular Manufacturing
An approach where manufacturing work centers (cells) have the total capabilities needed to produce an item or group of similar items; contrasts to setting up work centers on the basis of similar equipment or capabilities, in which case items must move among multiple work centers before they are completed.
- d) Just in Time (JIT) / Kanban
Just in time is a production scheduling concept that calls for any item needed at a production operation – whether raw material, finished product, or anything in between – to be produced and available precisely when needed.
- e) Total Productive Maintenance (TPM)
An approach to enlist operators in the design, selection, correction, and maintenance of equipment to ensure that every machine or process is always able to perform its required tasks without interrupting or slowing down defect free production.
- f) Six Sigma
A methodology and collection of statistical tools to reduce variation and improve business processes.

2.3.3 Advanced Lean Enterprise Methods

- a) Pre-Production Planning (3P)
The lean method for product and/or process design. 3P designs and implements production processes, tools, and equipment that support one-piece flow, are designed for ease of manufacturing, and achieve appropriate cost, quality, and lead time.
- b) Lean Enterprise Supplier Networks
A set of buyer-supplier relationships where organisations apply lean production concepts across the supply chain to reduce costs, delays, and other wastes.

2.4 Applying Lean Principles in Construction

The lean principles can only be applied fully and effectively in construction by focusing on improving the whole process. This means that all parties

have to be committed, involved, and work to overcome obstacles that may arise from traditional contractual arrangements. Lean principles could be applied during the following stages of the construction process.

- ❖ Design
 - a) Use of visualization techniques such as Virtual Reality and 3D CAD to fully define the product requirements from the client's perspective.
 - b) Value Management to achieve more understanding and focus on client value.
 - c) Use of integrated design and build arrangements (including partnering) to encourage close co- operation between designers, constructors and specialist suppliers.
 - d) Design for Standardization and Pre-assembly – both of components and processes to achieve higher quality and cost and time savings.
- ❖ Procurement
 - a) Supply chain management and rationalization of the supply chain to integrate all parties who contribute to the overall client value into a seamless integrated process.
 - b) Transparency of costs.
 - c) The elimination of waste in both processes and activities requires a clear and complete understanding of costs to ensure decisions on client value can be taken. Confidentiality of cost and cash flows must be addressed.
 - d) The concept of partnering, all involved parties contributing to a common goal with the boundaries between companies becoming less critical.
- ❖ Production Planning
 - Benchmarking to establish 'best in class' production methods and outputs.
 - Establishment of a stable project program, with clear identification of critical path.
 - Risk management - to manage risks throughout the project.
- ❖ Logistics
 - a) Just-in-time delivery of materials to the point of use eliminates the need for on-site storage and double- handling.
- ❖ Construction
 - a) Clear communication of project plans.
 - b) Training, teamwork, multi-skilling.
 - c) Daily progress reporting and improvement meetings.
 - d) A well motivated, well trained, flexible and fully

engaged workforce (Constructing Excellence, 2004).

2.5 Concept of Value

The Oxford Dictionary (2010) defines “value” as ‘the worth, desirability or utility of a thing, or the qualities on which these depend’. In construction, the term value is generally used to mean the balance between how well the building satisfies the owner’s expectations and the sacrifices, in terms of resources used, he must make in order to get it. The ratio between benefits delivered and resources used is referred to as the *Value Ratio*. Because the use of resources often comes down to money, the ratio is often referred to as VfM. Resources used in construction projects comprise land costs, materials, time and labour, which can be clearly measured. Although measurement of the financial benefits delivered could be assessed, non-tangible benefits, such as aesthetic considerations, require a different approach such as Value Management, SMART, Cost-benefit Analysis, etc. Dell’Isola (1997) mentioned that there are three basic elements that provide value to the client, namely: function, quality and cost. These elements can be interpreted by adding quality to the numerator of the above equation to form the following relationship:

$$\text{Value} = (\text{Function} + \text{Quality}) / \text{Cost (LCC)}$$

Where:

Function	=	The specific purpose or work that a design/item must perform
Quality	=	The client’s or user’s needs, desires and expectations
Cost	=	The total life cycle cost of the product

Maximizing the relationship of these three elements is necessary to satisfy the client. Hence, value could be enhanced by improving either function or quality or both, or by reducing the cost. A decision that improves quality but increases cost to a point where the product is no longer marketable is as unacceptable as one that reduces cost at the expense of the required quality or performance. In addition, if added cost does not improve quality or enhance the ability to perform the necessary functions, then value is decreased. A balance between value elements is required to achieve best value for money.

2.6 Client Value System

Client is defined as the customer of a professional service provider, or the principal of an agent or contractor (Business Dictionary, 2010). He/she is the person who receives a professional service or advice from a lawyer, accountant or architect, for instance. Client is the one who pays the bills (Chambers, 1990; Ahmed and Kangari, 1995). There are different types of clients in construction (Kelly and Male, 2005), namely:

➤ Public sector clients

National public, local public and public corporations

➤ Private sector clients

Individual domestic, individual commercial, corporate commercial, corporate industrial and corporate developer.

In spite of the type of client organisation either being public or private, large or small, regular or one-off, each client has distinct requirements and value system, driven by their own organizational configuration, business and/or social needs for a project, the external environmental drivers to which they have to respond and the manner in which they approach and interface with the construction industry (Othman, 2004; Kelly and Male, 2005). Defining client values at early stages of the project life cycle enables the design team to deliver a lean product that achieves client requirements at lowest waste possible.

2.7 Lean Principles for Delivering Innovative Sustainable Construction Projects

Lean principles in terms of maximising values and minimizing waste plays a significant role towards delivering innovative sustainable construction projects. Being one of the biggest industries worldwide, the construction industry has a negative impact on the environment, as around 3 billion tonnes of raw materials and 40% of the total global economy are used in manufacturing construction materials worldwide. Furthermore, the construction industry is accountable for about 50% of the material resources taken from nature, 40% of energy consumption and 50% of total waste generated. Large amounts of energy are consumed during the procurement of materials, construction activities and operating artificial heating and cooling systems (Anink et al., 1996; Othman, 2007). Overcoming these impacts necessitate that innovative solutions are developed to deliver sustainable projects. It is essential that companies operating in the construction industry adopt new techniques, such as lean principles that reduce resources waste and add better value through:

- 1) Saving the environment and reducing effluent generation, emissions to environment.
- 2) Reducing the impact on human health.
- 3) Using renewable raw materials.
- 4) Integrating ecological concerns with social and economic ones.
- 5) Eliminating toxic substances.
- 6) Adhering to international and national law.
- 7) Improving workers health and safety.
- 8) Achieving client and end-user requirements especially disadvantaged groups (e.g. disabled and low earners).
- 9) Reducing production cost through improving efficiency and reducing energy and raw material inputs.
- 1) Decreasing manufacturing cycle times and
- 0) creating better strategic focus.

- 1 Reducing labour while maintaining or
- 1) increasing throughput,
- 1 Reducing inventory while increasing client
- 2) service levels
- 1 Increasing capacity in current facilities
- 3)
- 1 Improving quality of life and increasing profits
- 4)
- 1 Increasing system flexibility in reacting to
- 5) changes in requirements
- 1 Improving cash flow through increasing
- 6) shipping and billing frequencies,
- 1 Increasing market share due to an improved
- 7) public image.
- 1 Creating new markets and opportunities for
- 8) sales growth.

3 BARRIERS TO IMPLEMENTING LEAN PRINCIPLES

There are three main barriers to implement lean principles, namely:

➤ Organisational resistance

Organisational resistance to adopt and implement lean principles goes through a cycle over time which affects the workforce's effectiveness, confidence and morale. The usual cycle of organisational resistance is: shock, denial, frustration, anger/confusion, acceptance, experimentation & understanding. Organizational resistance could be overcome through:

- Developing a clear case for change.
- Involving and training people from different business areas.
- Leading by example and empowering employees.
- Encouraging subordinates, highlighting success and providing constructive feedback

➤ Inadequate executive sponsorship

This is represented in areas of lack of resources, conflicting priorities and inadequate executive supporting behaviour. This could be overcome by selecting and developing team spirit to lead the change, providing adequate resources, developing effective measures that encourage new behaviour and pursuing value, not reducing costs.

➤ Unrealistic expectations

This barrier is represented in unrealistic timescales, quick major improvement, major change with small effort, believing that improvement is a one-off job, assuming that staff members have all needed skills and commitment and failing to stabilise existing business processes. These barriers could be overcome through setting adequate timescale for improvement, allocating resources carefully and training employees (Watson and Blumenthal, 2003).

4 CASE STUDIES OF INNOVATIVE SUSTAINABLE CONSTRUCTION PROJECTS BENEFITED FROM APPLYING THE LEAN PRINCIPLES

4.1 Case Study (1): The Recycled House, East Sussex, United Kingdom

The project was an old police house built in 1962 to provide accommodation for the police officer's family, with a single storey attached office, see figure (1). The office was converted to residential use in the 1990's, creating a self contained annex with a kitchen, bathroom and a tiny bedroom. The house and office were extremely poorly insulated, with no cavity wall or under floor insulation, basic loft insulation and ineffective and draughty uPVC windows.



Figure (1) The Recycle House

The Environmental Performance Certificates provided in the Home Information Packs (HIP) gave it a "G" rating - the lowest band. The certificates indicate that there is potential to improve to "E" ratings, but the client objective was to achieve at least a "B" for both. The idea of the Recycled House was to create a sustainable low-energy house with excellent environmental performance. Towards achieving these objectives, lean principles were adopted to accomplish the following actions.

Insulating the house sufficiently to allow all space heating to come from renewable sources included:

- Triple glazed timber framed windows and doors.

- 100mm of Ecotherm insulation under all ground floors.

- Black Mountain sheepswool insulation in roof spaces.

- Insulated timber weatherboard cladding to first floor elevations.

- Thorough draught proofing and insulation of all pipe work.

Using renewable solar thermal system to provide the house with 20 kWh out of 35 kWh to maintain living temperatures, heating needs as well as domestic hot water. This included the installation of 3 flat panel solar thermal collectors to provide most of the heat needed for around 9 months of the year. The solar Photo Voltaic system has been designed to benefit from the feed-in tariff and to charge a battery bank to allow off-grid operation of lighting and essential heating controls. All reusable materials are stored for future use, for example floorboards and internal bricks were cleaned and used in the garden studio. Non-reusable materials such as wood were used for heating, rubble was used to create an off road parking area and to build up tracks in local woodland. Excavated topsoil was used to create raised beds for vegetable planting and other soil for building up levels in the garden. Any other materials which can't be reused in the house was offered on Freecycle or taken to a local charity shop (The Recycled House, 2011).

4.2 Case Study (2): Grain Valley School District – Grain Valley, Missouri

When it was time to build a new Grain Valley middle school building (see figure 2), the school district's director of operations realized that the school needs HVAC that could provide a higher level of control than the mishmash of brands and units the district was using. Working with representatives of Lennox Industries, lean principles helped adopting the following actions which improved the school performance and sustainability.



Figure (2) The Grain Valley School District

1) Choosing high-efficiency rooftop units for the middle school installation helped dramatically reducing energy consumption by 25%. Each of the units featured an Integrated Modular Controller (IMC), which allowed for optimal control of the equipment and the easy installation of an

energy management system. The energy savings encouraged the district's director to install 150 rooftop units across the district.

2) Choosing systems that have no negative impact on the school environment in terms of installation, service and maintenance. The Lennox rooftop units feature full-perimeter base rails for easier rigging and transporting, and easy access to the compressor, refrigerant components and electrical controls to reduce service hours. In addition, the units' diagnostic features were designed to simplify diagnose and troubleshooting with more than 200 preprogrammed control parameters. This helped the client at Grain Valley who had no prior experience with an integrated control system (Lennox, 2011)

4.3 Case Study (3): Sutter Health, California, USA.

Sutter Health is a non-for profit health care provider company on the west coast, California established in 1996 as a merger of Sacramento-based Sutter Health and Bay Area-based California Healthcare System to meet the health care needs of their local communities. The company initiated the use of lean construction techniques in 2004 on all of its projects by introducing lean project delivery. Sutter uses a new contractual agreement called the Integrated Form of Agreement (IFOA), which embodies concepts found in a 'relational contract' rather than in the typical 'transactional contract'. The IFOA is signed by the owner, architect, and contractor. Rather than focusing on risk transfer, the agreement creates an Integrated Project Delivery Team that is responsible for the project management, and that deploys a policy of "share the gain and share the pain". The contract calls for a consensus based approach on making decisions. The core group, formed by members from all participating parties, adopts a Target Value Design approach to minimize the design and construction costs without sacrificing quality. In addition, the agreement highlights the sharing of incentives and savings by all parties proportionally, as agreed to by the team and in amounts proportional to the risk the part carried (Lichtig 2005).

5 DATA ANALYSIS

It is evident from literature review and case studies, mentioned above, that lean principles have proven to be beneficial to clients, architects, contractors, subcontractors and the construction industry at large. Lean principles when applied at the different stages of the project life cycle help delivering innovative sustainable construction projects through minimising waste, maximising resource usage, using renewable or recyclable resources, protecting the natural environment, creating a healthy, nontoxic environment and pursuing quality in creating the built environment. The construction industry is blamed of being a linear process. In other words, energy and natural resources are used to construct the built environment and then discharge waste such as the large quantities of debris left over from demolished buildings. The construction industry has to adopt a cyclical approach through putting a greater emphasis on recycled, renewed, and reused resources. This approach will be accompanied by reducing energy and resource consumption. Developing organizational

capabilities and changing behavioural are key aspects of implementation and success of lean principles and delivering innovative sustainable construction projects.

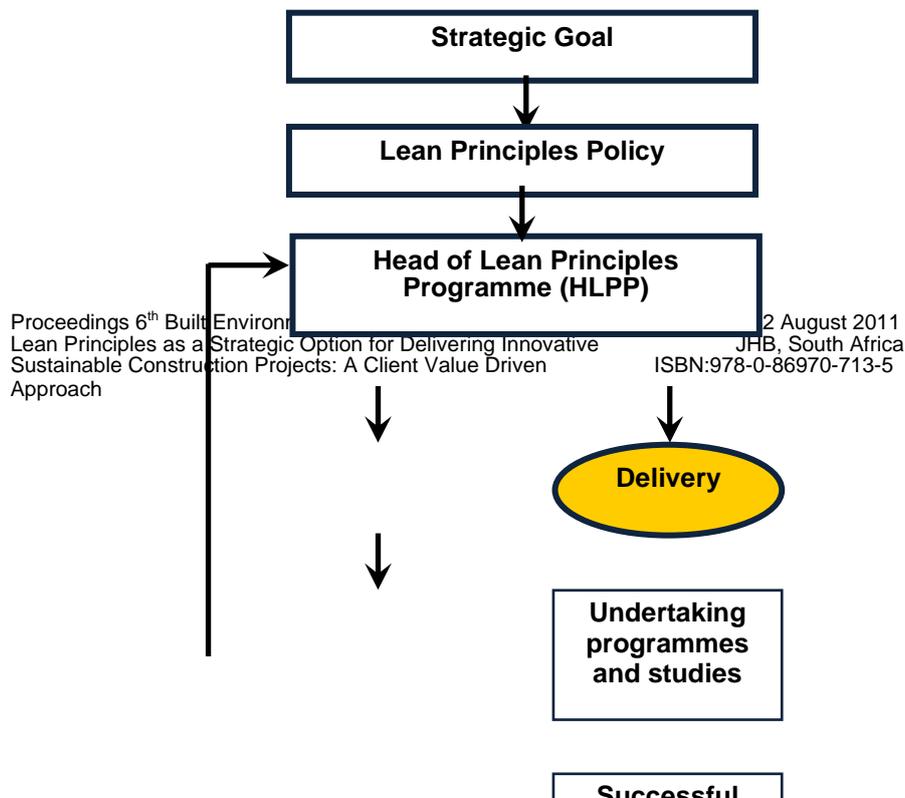
6 CRITICAL SUCCESS FACTORS FOR LEAN PRINCIPLES APPLICATION IN DESIGN AND CONSTRUCTION ORGANISATIONS

For a lean principles approach to be successfully implemented in construction, certain key principles should be in place. These may be termed the critical success factors (CSFs) for the lean principles approach. The following provide a useful basis to compiling the CSFs that apply specifically to design and construction organisations.

- Clear identification and visible senior management support for the approach.
- Explicit policies which are clearly communicated to all employees.
- Transparent and repeatable framework of activities.
- Creating a culture that supports and understands the concepts of maximising value and minimizing waste.
- Fully embedded management processes which are consistently and rigorously applied and are clearly linked to the achievement of objectives.
- Effective implementation of plans and regular reviews to ensure that the benefits of the approach are realised and lessons are learned for future programmes.

7 A FRAMEWORK FOR INTEGRATING LEAN PRINCIPLES IN DESIGN AND CONSTRUCTION ORGANISATIONS

If a design and construction organisation aims to actively adopt the lean principles it must ensure that the CSFs described above are embedded. This may be achieved by putting in place a framework of activities as shown in figure (3). The framework links lean principles to an organisation's strategic goals. This ensures that lean principles are aligned with the delivery of the goals. This section describes how to implement this framework.



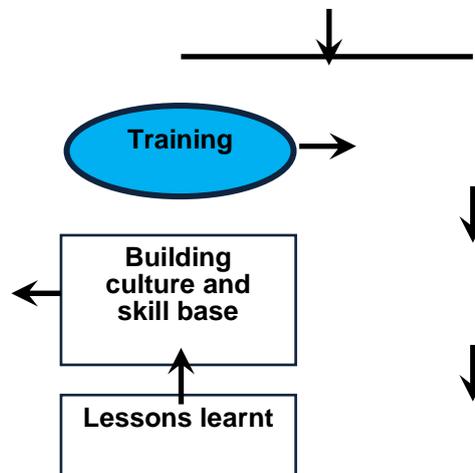


Figure (3) The Lean Principles Framework

7.1 Policy

The organization policy should establish, among other things why the organization supports the use of lean principles and what benefits this approach expects to generate. These could, for example, be related to some environmental, economic or social aspects, or be part of a broader perspective to enhance competitiveness or to follow best practice initiatives. The policy should provide clear guidance on when lean principles have to be integrated throughout the project life cycle and what are the resources needed. The policy should state, in broad terms, to which areas of the business the lean principles should be applied and provide guidance on the scale of that application. It should state whether the organisation intends to generate its own internal delivery capability, rely on buying in the expertise when needed or a mixture of the two. It should set out a timescale within which they expect to embed the practice of lean principle into the organisation's culture.

7.2 Champion

It is normal at this stage to appoint an individual to implement the policy. This individual will be designated as the head of lean principles programme (HLPP). Senior management has to form a small steering group, which is representative of the various parts of the organization, to whom the HLPP will report and discuss progress. Members of the steering group should report to the organisation's board of directors. The HLPP should possess a

sound understanding of lean principles and its application. He/she should draw up a plan setting out how the policy will be implemented. This will normally comprise two strands: training and service delivery.

7.3 Guidelines

The HLPP has to set out guidelines describing the types of study that should be conducted at strategic, programme, project and operational levels. The guidelines should outline the process to follow, list suitable techniques, provide guidance on who should be involved and the level of competence and experience of the leader who will lead the studies of implementing lean principles. The guidelines should provide the basis for delivering repeatable processes but not be so prescriptive as to stifle individual interpretation and innovation.

7.4 Training

The first step towards achieving the plan is training. It has to be shaped by the policy either by using internal or external expertise. If the organization plans to use only external expertise (e.g. lack of internal resources), the training programme will be focused on building up an awareness of the lean principles and their benefits at all levels of organisation. This is essential to gain support for the principles throughout the organisation and to build up a collaborative culture. If it is intended to build up internal delivery expertise it is essential to train up or employ internal study leaders to competent delivery skills levels. To ensure that the training programme is effective, it should be accredited by a competent organisation and lead to a professional qualification. Both the awareness and the practitioner training courses should align with the organisation's policy and its approach to doing business.

7.5 Delivery

The second step of the plan is the delivery of the services themselves within the designated projects using the appropriate techniques. The HLPP should gather feedback from all participants, in addition to the formal reports to build up an information base and learn from experience. The lessons learnt should be incorporated into the training programme and shared between employees to ensure that the quality of service is continuously improved.

8 CONCLUSIONS AND RECOMMENDATIONS

The construction industry is characterized by a number of problems such as time and cost overrun, insufficient quality, low productivity as well as poor safety which hinders delivering value products that achieve client satisfaction. The increasing recognition of clients as the core of the

construction industry and a driving force for improvement necessitated that these problems should be overcome through learning from other industries that made leaps of improvement. Lean principles, through focusing on maximising value and eliminating waste, are promising principles that enable construction professionals to deliver innovative sustainable products that achieve best value for money and client satisfaction. Design and construction firms have to perceive that lean transformation is a systemic process and a time and effort is required to realize the envisaged benefits. Developing policy, appointing skilled champion to lead the change process, setting guidelines, training employees and using the appropriate delivery of service are essential for enabling organization to adopt and successfully implement lean principles in construction.

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Perspectives for the implementation of Lean Construction in the Ghanaian Construction Industry

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ABSTRACT

Purpose:

Lean construction, if adopted could prove to be highly rewarding to Ghanaian construction organizations, resulting in the reduction of waste and improvement in productivity. This paper presents results of a study to assess the perceptions of Ghanaian construction practitioners of the lean construction philosophy and to identify the level of knowledge in the construction industry.

Design/Methodology/Approach: A structured questionnaire survey was conducted on technical managers of construction organizations and consultants to assess their perceptions of the lean construction philosophy, identify the level of knowledge in the Ghanaian construction industry and measures to bridge the knowledge gap. Data obtained from the study were ranked according to their mean scores.

Findings: There is the existence of a good level of awareness, but a low level of familiarity and application of lean construction among practitioners in the Ghanaian construction industry. Majority are considering application of lean concepts in future. Lean principles are considered transferable to construction in Ghana and construction practitioners suggest that to deal with the knowledge gap, firms should change organizational culture that does not promote lean construction and the construction industry should organize workshops and conferences to increase the level of awareness and bridge the knowledge gap on lean construction in Ghana.

Research Limitations/Implications: The study should have covered all categories of contractors but due to lack of reliable information on small scale construction organizations, only large firms in the highest financial classes were covered.

Practical Implication: The findings from the study enable the Ghanaian construction industry to organize training workshops and conferences for key players in the industry to increase their level of awareness and to bridge the knowledge gap on lean construction.

Originality/Value: The findings of the study are of value to construction organizations seeking to improve productivity and work quality through the adoption of the lean construction approach.

Keywords: Lean construction, perceptions, knowledge level, construction industry, Ghana

1. INTRODUCTION

According to Forbes and Ahmed (2004), manufacturing industries have greatly improved their competitiveness through the use of lean methods such as Supply Chain Management and Just-In-Time techniques. However, the majority of construction works is still based on antiquated techniques, especially in developing nations. Among the well known chronic problems in construction are low productivity, insufficient quality, poor co-ordination, high costs resulting from materials wastage etc. (Alinaitwe, 2009; Kpamma, 2009). Research has pointed to a significantly high level of wasted resources in the construction industry - both human and material; up to 30% of construction costs are due to inefficiencies, mistakes, delays and poor communications (Begum et al., 2006; Forbes and Ahmed, 2004; Polat and Ballard, 2004). In developing countries where a significant percentage of materials and equipment are imported, these problems can be especially costly (Forbes and Ahmed, 2004). Lean concepts have been applied in the construction industries of Australia, Brazil, Denmark, Ecuador, Finland, Peru, Singapore, UK, USA and Venezuela (Abdullah *et al.*, 2009; Johansen and Walter, 2007; Ballard and Howell, 2004). The surveys conducted by Johansen et al. (2002) and Common et al. (2000) in the Netherlands and the UK respectively, strongly suggest that the construction industry has generally been slow in taking up lean concepts (Johansen and Walter, 2007). Conventional construction has been criticized for being pre-occupied with managing only tasks, and flows are neglected. This is seen as the main reason why construction is characterized by a high share of non value-adding activities (Dulaimi and Tanamas, 2001). A case study in the USA showed the following remarkable benefits of implementing Lean Construction (Dulaimi and Tanamas, 2001):

- Office construction times reduced by 25% within 18 months;
- Schematic design reduced from 11 weeks to 2 weeks;
- Turnover increased between 15% to 20% (Pacific Contracting);
- Satisfied clients eager to place repeat orders;
- Overall project cost reduced.

The significant benefits of low waste generation and high productivity from lean construction (LC) reported in the literature (Mossman, 2009; Lehman and Reiser, 2004) could also be gained by Ghanaian construction organizations if the concept is adopted. There are, however, a number of factors that affect the construction industry in Ghana. The industry experiences problems of increased cost of production, delays in delivering construction products and services, incidence of waste associated with production, poor design quality, personnel issues and financial problem such as cancellation of advance mobilization, cumbersome payment process, limited access to credit and lack of adequate equipment holdings (Laryea and Mensah, 2010). The application of the LC concept in the Ghanaian construction industry is still considered a new approach, hence the objective of this study, which is to assess the perceptions of Ghanaian construction practitioners of the lean construction philosophy, identify the level of knowledge in the construction industry and measures to bridge the knowledge gap.

The concepts of lean construction

Lean Production (LP) was developed in the 1950s to eliminating waste (Kempton, 2006; Lehman and Reiser, 2004; Dulaimi and Tanamas, 2001). Seven wastes in mass production systems were identified as overproduction, waiting time, transportation, processing itself, having unnecessary stock on hand, using unnecessary motion and producing defective goods (Forbes and Ahmed, 2004). The term “lean” was coined by a research team working on international auto production to contrast it with craft and mass forms of production (Kempton, 2006). The original thinking was to develop a delivery process that met customers’ needs with very little inventory, and failure to meet customers’ needs was considered as waste. Working without inventory meant that the production line had to speed up, and each person involved in that process had to improve his skills in order to accomplish the production targets (Forbes and Ahmed, 2004). The core principle behind LP is to ensure the flow of value creating work steps while eliminating non-value steps (i.e. waste) by focusing on fast cycle times. When waste is removed from the production process, cycle times drop until physical limits are reached. In Japanese the primary goal of LP is “Muda”, that is, to avoid waste of time, money, materials, equipment, etc. (Kempton, 2006). Waste in construction and manufacturing arises from the same activity-centered thinking. There is the need to maintain pressure on every activity to ensure continuous improvement through the reduction of cost and duration of each activity (Kempton, 2006).

Lean theory and principles taken together provide the foundation for a new form of project management (Dulaimi and Tanamas, 2001). From roots in production management, LC is a way to design production systems to minimize waste of materials, time and effort in order to generate the maximum possible amount of value (Koskela and Howell, 2002). It is also a

holistic design and delivery philosophy with an overarching aim of maximizing value to all stakeholders through systematic, synergistic and continuous improvements in the contractual arrangements, product design and method of selection, the supply chain and the workflow reliability of site operations (Abdelhamid, 2004). LC has produced significant improvements particularly on complex, uncertain and quick projects. According to Dulaimi and Tanamas (2001), managing construction under LC is different from typical contemporary practice because it:

- Has a clear set of objectives for the delivery process;
- Is aimed at maximizing performance for the customer at the project level;
- Designs concurrently product and process;
- Applies production control throughout the life of the project.

The principles of lean construction

“Lean” is essentially about getting the right things to the right place at the right time, in the right quantity whilst minimizing waste and being open and responsive to change (Kempton, 2006). Lean production has an underlying philosophy that, by eliminating waste, quality can be improved, and production times and costs reduced (Kempton, 2006). In order to reduce waste, a set of key manufacturing principles should be employed (Table 23.1).

Table 23.1 Key manufacturing principles employed to reduce waste

Lean Principle	Explanation
Perfect first- time quality	Achieve zero defects, revealing and solving problems at the source
Waste minimization	Eliminating all non-value-adding activities and maximizing the use of resources
Continuous improvement	Reduction of costs, increase quality and productivity
Pull processing	Products pulled from the consumer end, i.e. not pushed from the production end
Flexibility	The production of different mixes and/ or greater diversity of products, without compromising efficiency
Relationships	Building and maintaining long-term relationships with suppliers

Source: (Kempton, 2006)

2. RESEARCH DESIGN AND METHODOLOGY

A thorough review of literature was undertaken to extract available lean principles, benefits and possible measures to bridge the knowledge gaps on the concept of LC. The benefits and possible measures to bridge the knowledge gap gathered from literature had been successfully and sufficiently studies in similar research in other countries (Bashir et al, 2010; Kpamma, 2009; Jin, 2008; Johansen, 2007; Kempton, 2006; Salem et al., 2006). A structured questionnaire survey which targeted chief executives of construction organizations and consulting firms was used in the study. Both closed and open-ended questions were administered to contractors and consultants. The questionnaire was divided into three sections. The first part sought information about the companies' profiles, areas of operations and level of experience of respondents. The second part of the questionnaire sought to assess respondents' familiarity with the lean principles. The third part dealt with the benefits of lean construction and measures to bridge the knowledge gaps on lean construction.

Building construction organizations operating within Ghana register with the Ministry of Water Resource, Works and Housing (MWRWH) in four categories: class D, K, E and G, based on the nature of work the organizations engage in - building, civil engineering, electrical and plumbing works respectively. There are four financial sub-classifications within these categories - Class 1, 2, 3 and 4 - which set the limitations for companies in respect of their asset, plant and labor holdings, and the nature and size of the projects they can undertake. Class 1 has the highest resource base, decreasing through classes 2 and 3, to class 4 having the least resource base (MWRWH, 2011). Chief executives of D1 and D2 building construction organization who are registered with the (MWRWH) were involved in the study. The choice of D1/D2 firms was due to lack of reliable information on small scale construction organizations and also based on the assumption that large and well-established firms have good organizational set up and are more capable of undertaking lean production efforts. The MWRWH (2011) records indicate that there are 519 D1 and D2 building contractors in the Ashanti and Greater Accra Regions of Ghana. The survey also targeted consultants from quantity surveying and architectural firms fully registered with the Ghana Institution of Surveyors (GhIS) and the Architects Registration Council of Ghana (ARCG) respectively. The ARCG (2010) had 114 fully registered architectural firms, whilst the GhIS (2010) had 60 fully registered quantity surveying firms in Kumasi and Accra.

A sample size of 226 site managers of D1/D2 of construction organizations was determined using the following formula recommended for such studies by Israel (1992).

$$n = \frac{N}{1 + N(e)^2}$$

where n is the sample size, N is the population size and e is the desired level of precision ($\pm 5\%$).

A simple random sampling approach was used to select the 226 D1 and D2 firms. Each questionnaire was administered through a face-to-face session

which ensured that 188 questionnaires out of the 226 were returned complete and used in the analysis, representing a response rate of 83%. All the 114 architectural firms (ARCG, 2010) and 60 quantity surveying firms (GhIS, 2010) fully registered with their professional institutions were covered in the study. Out of the 174 questionnaires sent to the consultants, 124 were completed, representing a response rate of 71%.

A quantitative approach to data analysis was employed. Statistical Package for Social Scientists version 16 (SPSS V16) was used to analyze the data. Concerning the principles of lean construction, the respondents were asked to indicate their level of agreement to the application of the principles on a five- point Likert scale (from 1= 'highly disagree' to 5 = 'highly agree'). For the achievability of customer values, respondents were asked to rank from 1 = 'highly unachievable' to 5= 'highly achievable'. For the benefits of lean construction, the respondents were asked to rank from 1 = 'highly unbeneficial' to 5 'highly beneficial' and for measures to bridge the knowledge gap, respondents were asked to rank from 1 'highly unimportant' to 5 'highly important'. The factors were ranked according to their mean scores.

3. RESULTS AND DISCUSSIONS

Company profile

The average years of experience of the firms surveyed in the construction market are between 10 and 20 years. This implies that all the firms have significant experience in the building industry. With regards to the average number of permanent and temporary employees, none of the firms contacted was willing to disclose. The main reason given was that it is confidential. The respondents, however, indicated that they had enough employees and could recruit additional employees when necessary.

Architects constituted 58% and quantity surveyors constituted 42% of the consultant. For the contractors, project managers constituted 68% and site engineers constituted 32%. Forty percent of the contractor-respondents and 50% of the consultant-respondents had bachelors' degree, and 36% of the contractors and 34% of consultants had Higher National Diploma (HND) certificates. The study further showed that 15% of consultants and 8% of the contractors had Master's degree. Nine percent of the contractors and 1% of the consultants had doctorate degree. The results also showed that majority of the firms (58% of contractors and 60% of consultants) had both public and private sector clients. Seven percent of contractors and 15% of consultants had public sector clients and 35% of contractors and 25% of consultants had private sector clients.

Familiarity with the concept of lean construction

On the level of awareness of LC, 80% of the contractors and 66% of the consultants indicated that they were either just aware of the lean principles or had adopted them in their construction projects. Only 20% of the contractors and 34% of the consultants were not aware of the lean principles. For the 39% of the contractors and 32% of consultants just aware of LC, they became aware through interaction with their colleagues in other firms or heard about it in school, but they have not gone beyond thinking of introducing it. For 41% of the contractors and 34% of consultants with experience on lean construction, the study showed that only few lean principles such as 'just in time' and 'use of prefabricated components' had actually been adopted in their construction projects. The 39% of the contractors and 32% of consultants just aware of Lean construction admitted that although lean principles are not applied in their activities, they are considering its application in the future. This result gives hope about future implementation of lean principles in the Ghanaian construction industry. The results indicate a good level of awareness, but a low level of familiarity and application of lean concepts in the Ghanaian construction industry.

The above results compare with findings from the literature regarding the initial level of familiarity and application of lean concepts in the UK, the Netherlands and in Germany. In the UK survey, Common et al (2000) found a distinct lack of understanding and application of the fundamental techniques required for a lean culture to exist. In the case of the Netherlands, Johansen et al. (2000) concluded that the lean concept appeared to be largely unknown although some issues associated with it had some low penetration in the industry.

Application of lean principles to project execution

Respondents were asked to indicate which of the basic principles of lean construction they agreed or disagreed with and which they think should be considered when carrying out projects.

The results (Tables 2 and 3) show that mean scores of all the 10 principles evaluated are greater than 2.5 for both the consultants and the contractors. This indicates that the respondents agree with all the ten basic principles of lean construction, and that the principles should be considered during project execution. The results further show that the respondents consider 'establishing continuous improvement', 'delivering what the client wants', 'constantly seeking better ways to do things' and 'minimizing waste' as the first four important lean principles to be considered in project execution. Other important principles include 'building and maintaining long term relationships with suppliers' and 'avoiding defects in the works done'.

The above results agree well with the literature which lists basic principles of lean construction to include 'delivering what the client wants', 'establishing continuous improvement', and 'doing the right things the first time' (Kempton, 2006; Mathew Hunter Associates, 2005; Salem and Zimmer, 2005; Dulaimi and Tanamas, 2001).

Table 23.2 Principles applied in carrying out projects – opinions of consultants

PRINCIPLE	MEAN SCORE	STANDARD DEVIATION	RANKING
Establishing continuous improvement	4.46	0.703	1
Delivering what the client wants	4.44	0.615	2
Constantly seeking better ways to do things	4.35	0.735	3
Waste minimization	4.25	0.717	4
Building and maintaining long term relationships with suppliers	4.21	0.768	5
Avoiding defects in the works done	4.15	0.985	6
Doing the right things at the first time	4.14	0.679	7
Involving the whole project team from the design right through to construction	4.10	1.039	8
Increasing output value through systematic consideration of customer requirements	3.91	0.786	9
Increasing output flexibility	3.58	1.045	10

Table 23.3 Principles applied in carrying out projects – opinions of contractors

PRINCIPLE	MEAN SCORE	STANDARD DEVIATION	RANKING
Establishing continuous improvement	4.16	0.780	1
Delivering what the client wants	4.07	1.000	2
Involving the whole project team through the design to construction	4.05	0.885	3
Waste minimization	3.92	0.889	4
Constantly seeking better ways to do things	3.90	1.067	5
Avoiding defects in the works done	3.89	1.044	6
Increasing output value through systematic consideration of customer requirements	3.88	0.779	7
Doing the right things at the first time	3.71	1.072	8
Building and maintaining long-term relationships with suppliers	3.68	1.273	9
Increasing output flexibility	3.57	1.029	10

Transferability of lean principles to construction

On transferability of lean principles into the construction industry, all the consultants and the contractors admitted that it would be possible to transfer the principles of lean construction to the construction industry. This positive indication should motivate the industry to intensify efforts towards successful implementation of LC, as construction environment becomes increasingly demanding, and processing of modern-day projects almost certainly determined by increasing technological and financial pressure (Johansen and Walter, 2007). Transferability of lean principles into the construction industry can help to change current practices such as the generation of excessive waste and sub-standard products.

Achievability of customer values

All the respondents were of the opinion that customer values are very important and highly achievable in their firms. The respondents' evaluation of the level of achievability of various customer values is presented in Tables 4 and 5.

Mean scores of the customer values evaluated are all greater than 2.5, indicating that in the opinion of the respondents, they are all significantly important and achievable within their firms' activities. Whereas the consultants consider 'minimizing waste' as the most important and achievable customer value, the contractors consider 'keeping everything simple right from design to construction'. Other customer values such as 'perfect first time', 'continuous improvement' and 'increasing output flexibility' are considered significantly important and achievable by both the contractors and the consultants.

Table 23.4 Achievability of customer values – perception of contractors

VALUES	MEAN SCORE	STANDARD DEVIATION	RANKING
Keeping everything simple, right from design to completion	4.01	0.801	1
Continuous improvement; reduction of costs, increase quality and productivity	3.88	0.694	2
Minimizing waste; eliminating all non-value adding activities and maximizing the use of resources	3.73	0.787	3
Increasing output flexibility including the production of different mixes and or greater diversity of products, without compromising efficiency	3.68	0.771	4
Perfect first time quality;			

achieving zero defects, revealing and solving problems at the source	3.67	0.659	5
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Table 23.5. Achievability of customer values – perception of consultants

VALUES	MEAN SCORE	STANDARD DEVIATION	RANKING
Minimizing waste; eliminating all non-value adding activities and maximizing the use of resources	4.10	0.663	1
Continuous improvement; reduction of costs, increase quality and productivity	3.95	0.656	2
Perfect first time quality; achieving zero defects, revealing and solving problems at the source	3.80	0.802	3
Keeping everything simple, right from design to completion	3.79	0.898	4
Increasing output flexibility including the production of different mixes and or greater diversity of products, without compromising efficiency	3.68	0.945	5

Benefits of lean construction

The respondents were asked to evaluate nine benefits gathered from the literature and confirmed through interviews. Mean scores and rankings of the benefits are presented in Tables 6 and 7 for consultants and contractors respectively.

The consultants perceived that the first three most important benefits expected from the application of lean construction are 'improvement of project delivery methods', 'promotion of continuous improvement in project delivery methods through lessons learned' and 'delivery of products or services that enable clients to better accomplish their goals'. To the contractors, 'delivery of products or services on time and within budgets', 'promotion of continuous improvement in project delivery methods through lessons learned' and 'delivery of products or services that enable clients to better accomplish their goals' are the first three most important benefits likely to be achieved from the application of lean principles. Other benefits (Tables 6 and 7) were also considered beneficial in the opinion of the contractors and consultants.

The findings from this study confirm those from the literature. Mossman (2009) and Lehman and Reiser (2004) reported of benefits from LC such as

'more satisfied clients', 'productivity gains', 'greater predictability', and 'shorter construction periods'.

Table 23.6 Benefits of lean construction- perception of consultants

BENEFITS	MEAN SCORE	STANDARD DEVIATION	RANKING
Improvement of project delivery methods	4.31	0.616	1
Promotion of continuous improvement in project delivery methods through lessons learned	4.29	0.784	2
Delivery of products or services that enable clients to better accomplish their goals	4.20	0.662	3
Delivery of products or services on time and within budget	4.15	0.807	4
Minimization of risk and maximization of opportunities	4.14	0.654	5
Well-informed business decisions at all project levels	4.13	0.733	6
Delivery of custom product, instantly, without waste.	4.12	0.832	7
Injection of reliability, accountability, certainty, and honesty into the project environment	4.08	0.717	8
Minimization of direct costs through effective project delivery management	4.06	0.641	9

Table 23.7 Benefits of lean construction- perception of contractors

BENEFITS	MEAN SCORE	STANDARD DEVIATION	RANKING
Delivery of products or services on time and within budget	4.43	0.612	1
Promotion of continuous improvement in project delivery methods through lessons learned	4.27	0.673	2
Delivery of products or services that enable customers to better accomplish their goals	4.23	0.502	3

Minimization of direct costs through effective project delivery management	4.20	0.740	4
Well-informed business decisions at all project levels	4.14	0.808	5
Improvement of project delivery methods	4.12	0.834	6
Minimization of risk and maximization of opportunities	4.07	0.734	7
Injection of reliability, accountability, certainty, and honesty into the project environment	4.03	0.734	8
Delivery of custom product, instantly, without waste.	4.01	0.767	9

Measures to bridge the knowledge gap

On measures which would bridge the knowledge gap on lean construction, mean scores and their rankings are presented in Tables 8 and 9 for consultants and contractors respectively.

From the evaluation of the consultants, the first three most important measures to bridge the knowledge gap are 'firms should change organizational culture that does not promote lean construction', 'promotion of the concept of lean construction to firms, professional bodies and major stakeholders' and 'the construction industry should fund workshops and research conferences to promote transfer of knowledge on lean construction'. To the contractors, however, 'training of employees at all levels on lean construction', 'engagement of competent and skilled site operatives' and 'promotion of the concept to companies, professional bodies and major stakeholders' are the first three most important measures. The other measures considered important are also ranked in Tables 8 and 9. Mean scores of all the measures to bridge the knowledge gap are greater than 2.5, indicating their significance for bridging the knowledge gap on lean construction.

Table 23.8 Measures to bridge knowledge gaps- perception of consultants

MEASURES	MEAN SCORE	STANDARD DEVIATION	RANKING
Firms should change organizational culture that does not promote lean construction	4.479	0.542	1
Promotion of the concept to firms, professional bodies and major stakeholders	4.442	0.596	2
The construction industry should fund workshops and			

research conferences to promote transfer of knowledge on lean construction	4.383	0.639	3
Training of employees at all levels on lean construction	4.356	0.721	4
Engagement of competent and skilled site operatives	4.330	0.535	5
Working on improving performance when carrying out projects.	4.297	0.758	6
Construction managers should be committed to changes	3.888	0.726	7

Table 23.9 Measures to bridge knowledge gaps- perception of contractors

MEASURES	MEAN SCORE	STANDARD DEVIATION	RANKING
Training of employees at all levels on lean construction	4.413	0.583	1
Engagement of competent and skilled site operatives	4.347	0.820	2
Promotion of the concept to firms, professional bodies and major stakeholders	4.262	0.706	3
The construction industry should fund workshops and research conferences to promote transfer of knowledge on lean construction	4.222	0.656	4
Working on improving performance when carrying out projects	4.183	0.720	5
Construction managers should be committed to changes	4.095	0.824	6
Firms should change organizational culture that does not promote lean construction	4.079	0.699	7

4. CONCLUSION AND RECOMMENDATIONS

The structured questionnaire survey has shown the existence of some level of awareness among professionals in the Ghanaian construction industry on the concept of lean construction. Principles adopted by construction

organizations in their activities such as 'delivering what the client wants', 'establishing continuous improvement', 'constantly seeking better ways to do things', 'waste minimization' and 'avoiding defects in works done' are observed to be generally consistent with lean construction practice. Majority of the construction professionals surveyed are receptive to lean principles implementation in the construction industry, and are also of the opinion that the transfer of lean construction principles into the construction industry would bring a lot of benefits including 'improvement of project delivery methods' and 'delivery of products or services that enable clients to better accomplish their goals'. In order to bridge the knowledge gap, it is suggested among others that construction firms should change organizational culture that does not promote lean construction and also promote the concept of lean construction through workshops and conferences.

Although the study failed to cover all categories of contractors due to lack of reliable information on the large number of small scale contractors, the fact that Ghanaian construction practitioners are ready to accept and implement the concept of lean construction gives hope for the future. The study findings are of value to construction organizations seeking to improve productivity through work efficiency and materials waste reduction in their operations. The adoption of lean construction would prove to be rewarding in these regards. Further research is suggested on the perceptions of construction clients of the lean construction philosophy.

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Exploratory analysis of the relationship between transformational leadership of middle managers and project performance

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ABSTRACT

Purpose of this paper: The purpose of this exploratory study was to investigate the effect of the individual dimensions of transformational leadership of middle managers on project performance.

Design/methodology/approach: Following a review of the extent literature on the role of transformational leadership on performance, data was obtained from a survey of 112 project managers for statistical analysis.

Findings: Five dimensions of transformational leadership; articulating vision, fostering commitment, high performance expectation, individualised support, intellectual stimulation and four components of project performance; achieving project efficiency, enhancing company image, promoting learning and improving team performance were extracted. Articulating vision, intellectual stimulation and fostering commitment were found to be the most important dimension of transformational leadership influencing project performance.

Research limitations/implications: The cross-sectional nature of the study implies that no definitive causal inferences could be drawn between the dimensions of transformational leadership and project performance. A longitudinal or experimental design in future studies could help establish causality.

Practical implications: The study highlighted the dimensions of transformational leadership project based organisations should develop in their middle managers in order to improve project performance.

What is original/value of paper: Whereas most research on leadership in project management have focused on the leadership of project managers, this study highlights the significant direct impact middle managers could have on project performance. It further explores the relationship between transformational leadership and project performance in much more detail than in previous studies.

Keywords: middle managers, project performance, project based firms transformational leadership

1.1 INTRODUCTION

The need for projects to meet and exceed the expectations of increasingly demanding clients and achieve business performance objectives has seen many researchers and practitioners in search for factors that influence project success. Leadership behaviour has been recognised as one of such factors, (Yang, Huang and Wu, 2010a).

In project based organisations, leadership research has largely focused on the leadership style of project managers and less so on middle managers who appoint and supervise project managers. With few notable exceptions (e.g. Muller and Turner, 2007; Cheng et al., 2005) this important constituency has largely been ignored in leadership research in the project environment. These middle managers often run business units or divisions within which the project managers operate, and often act as project directors.

Most research on transformational leadership have focused on the impact of the leader behaviour on immediate subordinate (Bruton and Lau, 2008). Very few studies have investigated the influence of transformational leadership at levels beyond the immediate supervisor (Yang, Zhang and Tsui, 2010b). In that direction the study examines the influence of middle managers as distinct from that of project managers who directly run projects. Moreover, most research have investigated transformational leadership as a composite construct without a detailed examination of the individual dimensions of transformational leadership responsible for the observed or measured success criteria (Podsakoff et al, 1990).

This paper forms part of an on-going study which seeks to contribute to addressing this gap in literature. The emphasis of the study is on the transformational leadership behaviour as a managerial competency (Turner and Muller, 2005) exhibited by middle managers and how that influences project performance. The study further examines the individual dimensions of transformational leadership which have significant relationships with aspects of project performance. Findings from this study could deepen the theoretical support for the impact of middle management transformational leadership on project performance in project based

organisations.

Subsequent sections discuss the suggested relationships among the key constructs derived from extant literature and their role in influencing project performance. Statistical analyses conducted to investigate the relationships are presented. Preliminary findings and their theoretical and practical implications are subsequently discussed.

1.2 THEORETICAL BACKGROUND

1.2.1 Project Performance

The subject of project success has been widely debated among project management researchers with little agreement as to what constitutes project success. Various measures have been proposed for measuring the performance of projects. The most common among these is delivery to programme, budget and quality (Keller, 1992; Shenhar and Levy, 1997). Project outcomes have also been measured on the basis of financial performance (Salter and Torbett, 2003). Beyond these traditional measures, it is recognised that projects generally have different stakeholders with each having a different expectation of the project. Project performance measures will therefore have a different meaning to each of the stakeholders. Shenhar and Levy (1997) identified four dimensions of project performance measures. These include project efficiency, impact on the customer, business success and the future. Whereas project efficiency measures relate to short term traditional measures such as delivery to programme and budget, preparing for the future relates to building competencies to enhance future performance.

1.2.2 Transformational Leadership and Project Performance

The role of leadership in organisational performance has been studied for several decades. In a review of the leadership literature, Turner and Muller (2005) identified six primary schools of thoughts. Significant among them was the visionary school which comprises primarily of the transactional and transformational leadership styles. Transactional leadership epitomises the traditional leadership approach and focuses on the exchange between the leader and the employee of rewards for expected performance (Yang et al., 2010). Transformational leadership in contrast is an approach to leading that changes followers, causing them to look beyond self-interest in favour of the group's objectives by modifying their ideals and values (Pieterse et al, 2010). It is associated with stimulating and inspiring followers to deliver extraordinary results (Bass and Riggio, 2006).

As a higher order construct, transformational leadership comprises of several components (Pieterse et al, 2010). Podsakoff et al (1990) identified six dimensions of transformational leadership. These were articulating

vision, providing an appropriate model, fostering the acceptance of group goals, high performance expectations and intellectual stimulations. According to Podsakoff et al. (1990), by articulating vision, the leader identifies new opportunities for the unit, develops, articulate and inspires others with his or her vision and shows them how to achieve the vision. Also, by providing appropriate model, the leader lives the espoused values which become examples to the employees. In addition, the leader fosters the acceptance of group goals by promoting team effort towards the achievement of set goals. Moreover, high performance expectation behaviour of the leader is reflected in the leader's expressed belief in the ability of the employees to deliver excellence and high quality. Furthermore individualised support by the leaders is reflected in the show of respect and concern for the individual's needs. Finally through intellectual stimulation, the leader challenges the assumptions employees have about their work and encourage them to look at different ways of doing it better (Podsakoff et al., 1990).

The impact of transformational leadership on performance has been investigated in various organisational contexts over the years with different success criteria. These include project effectiveness (Keller, 1992), innovation (Jung, Wu & Chow, 2008), groups (Dvir et al., 2002) and commitment to change (Lo, et al., 2010).

In spite of the large number of empirical studies there is limited research in the context of the project based organisations (Turner and Muller, 2005; Yang et al., 2010).

The few studies undertaken in this context have mainly focused on the leadership style of project managers and not on middle managers. Moreover, the findings from such studies have been mixed. For example, Keegan and Den Hartog (2004) reported less preference for transformational leadership among project managers compared to line managers. Muller and Turner (2007) however, indicated that the impact of transformational leadership will be dependent on the type and complexity of the project. The authors further suggested that Keegan and Den Hartog (2004) could have had a different result had they investigated transformational leadership in more complex projects. By extension, transformational leadership theory will benefit from an examination from a different hierarchical level in the project environment. In addition this study will be relevant as it examines whether the individual dimensions of transformational leadership style of middle managers influences different dimensions of project performance. Given the dearth of literature specifically examining the individual dimensions of the two constructs, rather than proposing and testing hypothesis, this study sought to explore and report on the emergent relationships among them.

Consistent with Yang et al (2010), this study assumes that middle manager's influence on performance is distinct from the influence that project managers may have on the performance of project teams and therefore focuses on the impact of middle managers' influence on project

performance.

1.2 METHODOLOGY

1.2.1 Sample and procedure

Project managers in the organisation under study constituted the source of data. The focus on a single organisation allowed for the control of other influences on project performance such as organisational culture. In addition the organisation under study operates in a number of industries enabling integration of views from different sectors without the need to engage a number of different companies in the study. An internet based questionnaire was prepared and an e-mail with the link to the questionnaire was sent to approximately 350 project managers working in three primary business streams located in about 40 offices across the UK. Respondents were initially given two weeks to respond. There was an extension of one week. The respondents provided data on their perceptions of transformational leadership behaviour of their line managers (middle managers). They also provided data on the average performance rating of projects they have managed. There were 112 usable responses as outlined in Table 1 below.

Table 99.1 Frequency table

Item/range	Frequency	%
Age Group		
Less than 40 years old	44	39.3
40 years and above	68	60.7
Total	112	100.0
Tenure in Company		
Less than 5 years	54	48.6
5 years and more	55	51.4
Total	109	100.0
Level of Education		
Below 1st Degree	23	20.5
Above 1st Degree	89	79.5
Total	112	100.0

1.2.2 Measures

Transformational leadership was measured using Podsakoff et al's (1990) 22-items instrument on a 7 point likert scale (1-"Strongly Disagree" and 7-

“Strongly Agree”). Examples of the items included ‘insists on only the best performance’, ‘has provided me with new ways of looking at things which used to be a puzzle for me’ and ‘paints an interesting picture of the future for our group’. Project performance was measured with 11-item instrument multidimensional measurement of project performance developed by Dulaimi et al. (2005) on a 5-point scale (1-“Not at all” and “A great deal”). Sample items included ‘finish project within the budget’ and ‘enable competitive advantages to the company’. Control and demographic variables such as age and tenure were also measured.

1.2.3 Results

1.2.3.1 Factor Analysis

Exploratory factor analysis using principal component analysis with VARIMAX orthogonal rotation method was undertaken to confirm the number of factors underlying the constructs and determine the pattern of loadings. The 112 cases included in the analysis met and exceeded the minimum sample size of 100 required to meet the minimum recommended cases to variable ratio of 5:1 for each construct (Hair et al., 2006, Panuwatwanich et al., 2008). The Kaiser-Meyer-Olkin (KMO) measures were between 0.833 and 0.902; exceeding the recommended minimum of 0.6 (Field, 2009) and highlighting a high level of sampling adequacy.

Respectively, 5 and 4 factors of transformational leadership and project performance were extracted explaining 83.19% and 76.75% of the variance in the constructs. The Cronbach’s alpha (reliability coefficients) of all the scales ranged from 0.718-0.950; exceeding 0.7 level which is generally considered as good (Hair et al., 2006, Panuwatwanich et al., 2008).

1.2.3.2 Correlations

Tables 99.2 below shows the descriptive statistics and zero-order correlations among the dimensions. With the exception of individualised support which surprisingly did not have a relationship with any of the project performance dimensions the rest of the dimensions of transformational leadership had positive and significant relationships with project performance.

Fostering commitment was found to have had positive and significant relationships with the project performance dimensions of enhancing company image ($r=0.19$, $p<0.05$), improving team performance, ($r=0.26$, $p<0.01$) project efficiency ($r =0.22$, $p<0.05$) and promoting learning ($r=0.25$, $p<0.01$).

Articulating vision was found to have had positive and significant relationships with the project performance dimensions of enhancing company image ($r=0.24$, $p<0.01$), improving team performance, ($r=0.36$,

$p < 0.01$) project efficiency ($r = 0.27$, $p < 0.01$) and promoting learning ($r = 0.25$, $p < 0.01$).

Intellectual stimulation had positive and significant relationships with enhancing company image ($r = 0.23$, $p < 0.05$), improving team performance, ($r = 0.27$, $p < 0.01$) project efficiency ($r = 0.26$, $p < 0.01$) and promoting learning ($r = 0.25$, $p < 0.01$). High performance expectation only had a positive and significant relationship with promoting learning ($r = 0.19$, $p < 0.05$).

1.4 DISCUSSION

Whereas transformational leadership has been known to impact on performance, the result in the project environment has been inconsistent. The result from this study supports a positive link between transformational leadership of middle managers and project performance. This is consistent with the result of Bass and Atwater (1990) who in a study of R&D project teams found that transformational leadership of higher level managers positively influenced project effectiveness.

Table 99.2 Descriptive Statistics and Inter-correlations

	Mean	SD	1	2	3	4	5	6	7	8	9	10	11
1 Age	0.48	0.5											
2 Job Tenure	0.5	0.5	0.23*										
3 Individualised Support	4.72	1.35	0.04	0.02									
4 Fosters Commitment	4.9	1.38	0.09	0.04	.69**								
5 Articulates Vision	5.09	1.3	0.08	0.05	.55**	.82**							
6 Intellectual Stimulation	4.34	1.42	0.07	0.03	.39**	.62**	.65**						
7 High Performance Expectation	5.16	1.22	.2*	0.04	.26**	.56**	.61**	.484**					
8 Enhance Company Image	3.64	0.76	-0.1	-.258**	0.18	.19*	.24**	.23*	0.07				
9 Improving Team Performance	3.48	0.72	-0.1	-0.12	0.1	.26**	.36**	.27**	0.12	.65**			
10 Project Effective	4.07	0.78	-0.1	0.05	0.03	.22*	.25**	.26**	0.04	.38**	.4**		
11 Promote Learning	3.68	0.66	-0.1	-.194*	0.18	.25**	.27**	.25**	.19*	.57**	.48**	0.17	

Notes: * $p < 0.05$; ** $p < 0.01$. Sample size=112 individuals. Control variables are coded as follows: Age is coded 0=less than 40, 1=over 40. Job tenure is coded 0=less than 5 years; 1=more than 5 years.

The findings suggest that transformational leadership behaviour exhibited by middle managers could potentially bypass hierarchical links between middle managers and project managers and be experienced directly at the project team level and consequently impact on project performance. The direct effect of transformational leadership on performance at lower levels of organisations is supported in previous studies (e.g Dvir et al., 2002; Yang et al., 2010).

The study found that project managers' perception of the middle managers' behaviour in articulating vision had the most positive and significant relationship with all the dimensions of project performance. This finding is consistent with a number of studies on transformational leadership that has identified articulating vision as very important factor of transformational leadership with significant impact on organisational performance (Sarros et al., 2008; Yang et al., 2010).

The non-significant relationship between high performance expectation and project performance dimensions except promoting learning is somehow surprising given that other studies have found a link between this dimension and performance in general. However similar findings were made by Podsakoff et al. (1996) who suggested that there are two components to the effectiveness of high performance expectation. This comprises of communicating the high performance expectation clearly and expressing confidence in the followers' ability to achieve the expectation. According to Podsakoff et al. (1996), in a situation where the leader continually raises performance expectation levels without a corresponding expression of confidence in the followers' ability to meet it, there could be negative consequences. This could explain the findings in this study.

Individualised support was expected to have a positive relationship with project performance as employees who perceive their leaders to provide support tend to be more productive (Podsakoff et al., 1996). However it is also possible that in a professional services environment where people value their independence (Keller, 1992), too much of individualised support may be interpreted as a lack of trust in the employee's ability to manage and deliver project objectives on their own and lead to a negative outcome. This may explain the non-significant relationship observed.

The findings also suggest that fostering the acceptance of group goals and obtaining the commitment of individuals have a positive relationship with all the dimensions of project performance. As expected intellectual stimulation had a significantly positive relationship with project performance as challenging employees to look beyond the normal approach to delivering services impact on performance Podsakoff et al. (1996).

1.4.1 Practical/managerial implications

The findings from the study have a number of important practical implications for project based professional services firms and particularly for middle managers. Their position offers them an opportunity to influence the perceptions of their teams To enable middle managers to play their role effectively, it's important that they are helped to develop transformational leadership style for improved performance.

Particularly it's important that middle managers are able not only to formulate vision but also articulate it clearly to the teams. This will provide project teams a sense of purpose which has been found to be linked to improved team/project performance (Keller 1992). Middle managers promoting high performance expectations will also need to express the confidence in their teams that they are also able to achieve what is expected of them. Moreover individualised consideration should be practiced with care to ensure that project team members do not misinterpret that support to mean a lack of trust.

1.4.2 Limitations and future research

In spite of the significant findings in this study, it is not without limitations. The cross-sectional nature of the study implies that no definitive causal inferences could be drawn between the dimensions of transformational leadership and project performance. A longitudinal design in a future study will be useful in establishing causality. It is also worth noting that the assessment of the transformational leadership of middle managers and project performance were both provided by the project managers making this study liable to common source bias. However this is not considered a major issue as project managers reported on middle managers' leadership style and not their own. Also the project managers reported on project performance and not their personal performance and are more likely to be more objective. This notwithstanding, it will be interesting to have future studies obtain data from different sources and adopting more objective measures of project performance.

1.5 CONCLUSION

As previously highlighted, leadership research in project management has been focused primarily on the leadership style of project managers. This study has investigated the direct impact of middle managers on project performance by bypassing project managers.

This study suggests that when middle managers articulate a desirable vision for their business unit and each employee sees how the performance of their individual projects fit into the larger organisational goal, they will be willing to make the necessary commitment to achieving the organisation's project objectives. Future studies could adopt the longitudinal approach in order to establish causality.

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Barriers to Sustainable Implementation of Lean Construction in the Ghanaian Building Industry

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ABSTRACT

Purpose: Adoption of lean construction in the construction industry will improve quality and efficiency, eliminate waste and increase value for the client. It is a production-based management strategy that enables construction companies to maximize profits by maximizing efficiency and eliminating waste of resources. Lean production efforts in some countries have not been successful due to the many barriers to its successful implementation. This study was undertaken to identify possible barriers to successful and sustainable implementation of lean construction in the Ghanaian building industry and possible measures to overcome such barriers.

Design/Methodology/Approach: A structured questionnaire survey of 400 technical managers of construction organizations was carried out to identify possible barriers to implementation of lean construction and possible measures to overcome them in Ghana. Factor analysis using SPSS version 16 package was adopted to group the barriers identified. Measures identified were evaluated based on mean scores and ranked according to their strengths.

Findings: Difficulty in understanding lean concepts, inconsistency in government policies, poor project definition, incomplete designs, lack of standardization and lack of long term relationship with suppliers were some of the barriers identified and grouped into Managerial, Technical and Teamwork issues.

Research Limitations/Implications: The study should have covered all categories of contractors but due to lack of reliable information on the large number of small scale construction organizations, only large scale firms were studied.

Practical Implication: The paper provides possible barriers to the implementation of lean construction and possible measures to overcome such barriers in building projects to improve construction quality and efficiency.

Originality/Value: Identification of potential barriers and possible measure to overcome them are steps towards successful implementation of the lean concept in the Ghanaian building industry.

Keywords: Lean construction, barriers, building industry, Ghana

1. INTRODUCTION

The building industry is often described as an industry with many problems and lack of efficiency (Alinaitwe, 2009; Kpamma, 2009). Several researchers have expressed concern about the continued decline in performance of the construction industry and the increasing challenges facing the industry (Alinaitwe, 2009; Seranatne and Wijesini, 2008; Beathan *et al.*, 2004; Yasamis *et al.*, 2002; Anumba *et al.*, 2002; Abdulhadi, 1997). To deal with this situation, some construction companies have adopted Total Quality Management (TQM) system and others have tried rightsizing, restructuring and other concepts in order to reverse the trend (Alinaitwe, 2009; Abdul-Hadi *et al.*, 2005). The solution to this problem is said to be in using the concept of lean construction (LC) (Alinaitwe, 2009; Seranatne and Wijesini, 2008). The word lean is defined as “give customers what they want, deliver it instantly with no waste” (Howell, 2001). Lean production is currently a buzzword in many manufacturing industries and some organizations in the construction sector have tried to adopt it (Fellows *et al.*, 2002). The proponents of LC argue that it has the potential to tap into new and existing production theories dedicated to minimizing wasteful activities. LC has the goal of better meeting customers’ needs while minimizing waste and using fewer resources (Alinaitwe, 2009; Dunlop and Smith, 2004). LC concepts have recently received attention as a modern way to improve construction performance and labor productivity (Abdel-Razek *et al.*, 2007). It is one of the latest management concepts which advocates for minimizing waste in the construction process; a change the construction industry needs (Alinaitwe, 2009).

The LC concept has been introduced in the construction industry in various countries such as Australia, Brazil, Denmark, Ecuador, Finland, Peru, Singapore, United Kingdom, United States of America and Venezuela (Abdullah *et al.*, 2009; Johansen and Walter, 2007; Ballard and Howell, 2004), and its application within the industry is reported to have resulted in a lot of benefits. This is so because its approach is different from the normal practices within the construction process as it is based on

production management principles. LC also has better results in complex, uncertain and quick projects (Salem *et al.*, 2005). The following benefits are claimed for its implementation in the construction industries of many emerging economies (Mossman, 2009; Lehman and Reiser, 2004):

- more satisfied clients,
- productivity gains,
- greater predictability,
- shorter construction periods
- improved design
- reduced cost and less waste.

In spite of these benefits, the construction industry has generally been slow in taking up lean concepts (Johansen and Walter, 2007; Johansen *et al.*, 2002; Common *et al.*, 2000).

There are a number of factors that affect the construction industry in Ghana. The industry experiences problems of increased cost of production, delays in delivering construction products and services, incidence of waste associated with production, poor design quality, personnel issues and financial problem such as cancellation of advance mobilization, cumbersome payment process, limited access to credit and lack of adequate equipment holdings (Laryea and Mensah, 2010). The application of the LC concept in the Ghanaian construction industry is still considered a new approach.

Review of lean construction and barriers to its implementation

The traditional construction system is mainly project-based and characterized by one-of-a kind set-ups (Hook and Stehn, 2008; Vrijhoef and Koskela, 2005). The capability and efficiency of the construction sector need to be improved to modernize the sector and eventually increase user satisfaction (Alinaitwe, 2009). The various parties in the construction sector have undertaken numerous approaches to assist in establishing methods which are believed to be able to improve and subsequently increase the efficiency and effectiveness of the sector (Cohen, 2010; Alinaitwe, 2009; Mastroianni and Adelhamid, 2003).

LC is a way to design production systems to minimize waste of materials, time and effort in order to generate the maximum possible amount of value (Koskela *et al.*, 2004; Koskela and Howell, 2002). It is also a holistic design and delivery philosophy with an overarching aim of maximizing value to all stakeholders through systematic, synergistic and continuous improvements in the contractual arrangements, product design and method of selection, the supply chain and the workflow reliability of site operations (Abdelhamid, 2004). At the Design for Manufacture Competition (2005), LC was defined as the continuous process of eliminating waste, meeting or exceeding all customer requirements, focusing on the entire value stream and the pursuit of perfection in the execution of a project. In the opinion of Mossman (2009), lean thinking is lean because it provides a way to do more and more with less and less – less human effort, less

equipment, less time and less space – while coming closer and closer to providing customers with exactly what they want.

The building industry has a large number of specialized areas and disciplines, and many are based on cyclic processes. Proponents of lean construction argue that it is possible to identify the wasteful activities in the processes and make concessions for them, leading to better understanding and improvement in overall performance (Alinaitwe, 2009; Dunlop and Smith, 2004).

LC consists of a series of flow conversion activities (Alinaitwe, 2009). Conversion activities are those operations performed when adding value to the material or when information is being transformed into a product, and flow represents tasks like inspections, waiting, moving and storing (Alinaitwe, 2009). Harris et al. (2005) also define lean construction as a concept that incorporates several other concepts from the construction management industry such as Total Quality Management (TQM), Last Planner System (LPS), Business Process Re-engineering (BPR), Concurrent Engineering (CE), Product Circles (PCs) and Team and Value Based Management. In the opinion of Alinaitwe (2009), most of these concepts (Figure 1) are interrelated and all aim to improve performance while minimizing waste.

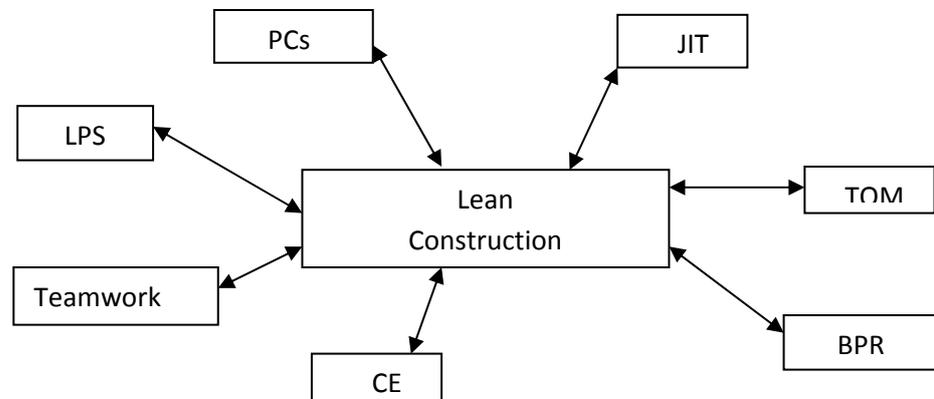


Fig 1 Key Concepts of Lean Construction (Alinaitwe, 2009)

As with implementation of other methods or approaches aimed at increasing the performance of the construction sector, the application process of lean principles is sure to encounter various obstacles. Research findings of the Production Management Center (GEPUC) of the Catholic University of Chile, has shown that the application of the LC concept in the industry has faced problems pertaining to time, training, organizational aspects and lack of self-criticism (Alarcon *et al.*, 2008). Furthermore, a major problem with the application of lean construction concept involves aspects of attitude, internal relationships and co-operation. The obstacles

within these aspects are related to lack of organizational culture supporting teamwork, lack of group culture, shared vision and shared consensus, inadequate knowledge and skills etc. (Castka *et al.*, 2004; Cua *et al.*, 2001; Conte and Gransberg, 2001).

There are various barriers to efforts aimed at sustainable implementation of the LC concept. Forty barriers to the implementation of lean construction and seventeen measures to overcome them were identified from literature (Bashir *et al.*, 2010; Abdullah *et al.*, 2009; Alinaitwe, 2009; Mossman, 2009; Jorgensen and Emmitt, 2008; Olutanji, 2008; Salem *et al.*, 2005; Forbes and Ahmed, 2004; Castka *et al.*, 2004; Alarcon *et al.*, 2002; Cua *et al.*, 2001; Common *et al.*, 2000). These barriers refer to attitude, roles, relationships, actions and communications among the respective parties involved in the construction industry such as contractors, sub-contractors as well as the client (Forbes and Ahmed, 2004). In the Ugandan construction industry, thirty-one factors were identified as barriers to successful implementation of LC (Alinaitwe 2009), out of which ten were considered easy to overcome. The barriers identified by Alinaitwe (2009) include lack of keeping items in the right places, lack of buildable designs, lack of a participative management style for the workforce, not using standard components, lack of communication within teams, lack of steady work engagement, lack of understanding of customer needs, lack of project team skill and lack of well-defined focus for the team. Kpamma (2009) studied the practice of lean thinking at the pre-contract stage of building construction projects by selected Ghanaian firms. The objectives of Kpamma's research among others included identification of the extent of practice of lean thinking and the limitations to the practice of lean construction in Ghana. Inadequate familiarity of the construction firms with the concept of lean thinking was among a number of limitations identified in the possible application of the concept in the Ghanaian construction industry.

Although the factors identified from literature seem relevant to the Ghanaian situation, little has been done to assess how they apply in Ghanaian construction projects. By identifying and prioritizing barriers to LC on the basis of their influence and ease of overcoming them, building organizations can undertake waste minimization efforts with confidence and manage the various barriers with success.

The main objective of this study is to identify and prioritize influential barriers to successful implementation of LC in the Ghanaian construction industry and recommend measures to overcome such barriers.

2. RESEARCH METHODOLOGY

To identify and prioritize influential barriers to successful implementation of LC in the Ghanaian construction industry, a thorough review of the literature was conducted. Forty barriers and seventeen measures to overcome them were identified (Bashir *et al.*, 2010; Abdullah *et al.*, 2009; Alinaitwe, 2009; Mossman, 2009; Jorgensen and Emmitt, 2008; Olutanji, 2008; Salem *et al.*, 2005; Forbes and Ahmed, 2004; Castka *et al.*, 2004; Alarcon *et al.*, 2002; Cua *et al.*, 2001; Common *et al.*, 2000). Since the barriers and measures gathered from the literature had been sufficiently tested and used in similar studies in other countries, they were used as basis for the present study.

A multiple research approach involving semi-structured interviews and a questionnaire survey was adopted for the study. Interviews were carried out prior to the questionnaire survey to examine the relevance of the identified factors in the Ghanaian context. Chief executives of building construction organization who are registered with the Ministry of Water Resource, Works and Housing (MWRWH) were involved in the study. Building construction organizations operating within Ghana register with the MWRWH. The Ministry has four categories of companies: D, K, E and G, based on the nature of work the organizations engage in - building, civil engineering, electrical and plumbing works respectively. There are four financial sub-classifications within these categories - Class 1, 2, 3 and 4 - which set the limitations for companies in respect of their asset, plant and labour holdings, and the nature and size of the projects they can undertake. Class 1 has the highest resource base, decreasing through classes 2 and 3, with class 4 having the least resource base (MWRWH, 2011).

The semi-structured interviews were conducted with five executive directors of D1/D2 firms operating in Kumasi and five academics who currently work with D1/D2 firms as project managers. The interviews led to the confirmation of 33 barriers and all the seventeen measures identified from the literature as relevant to the implementation of lean construction in Ghana. These factors were further investigated in the questionnaire survey. The survey targeted classes D1 and D2 building firms as well as consultants from quantity surveying and architectural firms fully registered with the Ghana Institution of Surveyors (GhIS) and the Architects Registration Council of Ghana (ARCG) respectively. The choice of D1/D2 firms was due to lack of reliable information on small scale firms, and also based on the assumption that large and well-established firms have good organizational set up and are more capable of undertaking lean production efforts. The records of the MWRWH (2011) indicate that there are 519 D1 and D2 construction organizations in the Ashanti and Greater Accra Regions of Ghana. Available records indicated that the ARCG had 114 architectural firms (ARCG, 2010), and the GhIS had 60 quantity surveying firms (GhIS, 2010) in Kumasi and Accra.

A sample size of 226 site managers of D1/D2 construction organizations was determined using the following formula recommended for such studies by Israel (1992).

$$n = \frac{N}{1 + N(e)^2}$$

where n is the sample size, N is the population size and e is the desired level of precision ($\pm 5\%$). A simple random sampling approach was used to select the 226 D1 and D2 firms.

Closed-ended questions were mainly prepared but options were given for respondents to add to the list of possible answers. The respondents were asked to score the severity of the 33 potential barriers to the implementation of lean construction on the Likert scale of 1-5 where 1= 'Not severe' and 5= 'Very severe'. Seventeen measures to overcome these barriers were also scored on a scale of 1-5, where 1= 'Highly unimportant' and 5= 'Highly important'. Each questionnaire was administered through a face-to-face session which ensured that 188 questionnaires out of the 226

were returned complete and used in the analysis, representing a response rate of 83%. All the 114 architectural firms and 60 quantity surveying firms fully registered with their professional institutions were covered in the study. Out of the 174 questionnaires sent to the consultants, 124 were completed, representing a response rate of 71%.

Data gathered was subjected to factor analysis using SPSS version 16 package. Factor analysis is a statistical technique used to identify a relatively small number of factors that explain observed correlations among variables (Marija, 2003). It is primarily used for data reduction or structure detection with the assumptions that the variables are continuous, normally distributed, have a good linear relation between them and have underlying factors responsible for the observed correlation. Factor analysis is used when people have been measured on several continuous variables and it is wished to see whether these variables can be reduced to a smaller set of variables (Chris 2004). It can also be used to identify any set of variables that correlate well with each other but less well with other items. It can be used to reduce a large number of correlated variables to a more manageable number of independent factors that can then be used in subsequent analysis (Marija 2003).

3. RESULTS AND DISCUSSIONS

Barriers to implementation of LC

Table 24.1 presents the results of the factor analysis carried out on the potential barriers to implementation of LC. A factor is deemed to be significant to the study if it has a mean value of 2.50 or more (Field, 2005). All the 33 factors have mean rating 2.50 or higher and were included in the factor analysis. All the 33 factors had communalities of 1.00, indicating their suitability for the factor analysis. The 33 significant factors were further reduced to common factor patterns. This was done to empirically explain the potential barriers to the implementation of LC in the Ghanaian construction industry. In doing this, principal component analysis with Varimax rotation and Kaiser Normalization was used to determine which factors have empirical significance. Factor retention was by the eigenvalue ≥ 2.0 criterion, suggesting that only factors that account for variances greater than two should be included in the factor extraction. This works best for this solution because individual variables have variance of 1.

The principal component analysis (Table 24.1.), where linear combinations of observed variables are formed, was the method used to extract the factors. The first principal component is the combination that accounts for the largest amount of variance and the second principal component accounts for the next largest amount of variance and is uncorrelated with the first. From Table 24.2., component 1 has total variance of 5.218, which accounts for 15.813% of the total variance of the 33 factors. Component 2 has total variance of 2.239 accounting for 6.784% of the total variance of the 33 factors, and component 3 has a total variance of 2.088 accounting for 6.327% of the total variance of the 33 factors. These three components constitute 28.924% of the total variance of the 33 factors.

From the 33 factors identified from the literature as potential barriers to implementation of LC, and then confirmed through meetings with practitioners, factor analysis enabled 14 of these significant barriers to be placed under three components as follows;

Component 1: corruption, difficulty in understanding lean concepts, inconsistency in government policies, poor project definition, lack of equipment and delays in material delivery.

Component 2: incomplete designs, lack of standardization, extensive use of subcontractors, lack of buildable design and lack of agreed implementation methodology.

Component 3: the fragmented nature of the construction industry, lack of long term relationship with suppliers and lack of client and supplier involvement.

Table 24. 1 Results from the factor analysis

N o.	Item	Me an	Std. Dev	Compon ent Matrix			Rotate d Compo nent		
				1	2	3	1	2	3
1	Lack of long term commitment to change and innovation	4.3	0.66						
2	Lack of top management support and commitment	4.2 6	0.72						
3	Corruption	4.2 5	0.83	0.54			0.55		
4	Lack of technical skills	4.2 4	0.76	0.51					
5	High level of illiteracy	4.2 3	2.93						
6	Inefficient use of quality standards eg. ISO 9000	4.2 1	0.79			0.56			0.64
7	Poor professional wages	4.1 9	0.69						
8	Poorly defined individual responsibilities	4.1 8	0.76						
9	Inadequate pre- planning	4.1 7	0.75						
10	High dependency of design specifications on insitu materials and components	4.1 6	0.75						
11	Incomplete designs	4.1 5	0.72					0.5 5	
12	Lack of long term relationship with suppliers	4.1 4	0.77			0.59			0.68

1	Delays in decision	4.1	0.79		
3	making	3			
1	Lack of	4.1	0.75		0.5
4	standardization	2			1
1	Materials scarcity	4.1	0.73		
5		1			
1	Difficulty in	4.1	0.76		0.57
6	understanding lean	1			
	concepts				
1	Inconsistency in	4.1	0.78		0.66
7	government policies	1			
1	Lack of interests from	4.1	0.77		
8	clients				
1	Lack of training	4.0	0.85		
9		9			
2	Lack of client and	4.0	0.79		0.57
0	supplier involvement	9			
2	Unsuitable	4.0	0.67		
1	organizational	8			
	structure				
2	Extensive use of	4.0	0.73		0.5
2	subcontractors	8			3
2	Less involvement of	4.0	0.87		
3	contractors and	7			
	specialists in design				
	process				
2	Poor project definition	4.0	0.84	0.57	0.66
4		6			
2	Lack of supply chain	4.0	0.65		
5	integration	3			
2	Waste accepted as	4.0	0.74		
6	inevitable	3			
2	Lack of buildable	4.0	0.78		0.5
7	designs	3			8
2	Lack of equipment	4.0	0.77		0.62
8		2			
2	Lack of agreed	4.0	0.72		0.5
9	implementation	1			9
	methodology				
3	Poor communication	3.9	0.76		
0		8			
3	Delay in materials	3.9	0.79	0.59	0.7
1	delivery	4			
3	Long implementation	3.9	0.72		
2	period	4			
3	Lack of awareness	3.9	0.86		
3	programms	2			

Note:

Valid N (listwise)= 400

Extraction method: Principal Component Analysis

Rotation Method: Varimax with Kaiser Normalisation

KMO value= 0.68

Bartlett's Test of Sphericity Significance level= 0.000

Insignificant factor loadings (i.e. < 0.5) are blanked.

Table 24.2 Total Variance Explained

component	initial Eigen-values			Extraction sums of squared loadings			Rotation Sums of Squared Loadings		
	Total	% variance	cumulative %	Total	% variance	cumulative %	Total	% variance	cumulative %
1	5.218	15.813	15.813	5.218	15.813	15.813	3.774	11.437	11.437
2	2.239	6.784	22.597	2.239	6.784	22.597	3.365	10.197	7.29
3	2.088	6.327	28.924	2.088	6.327	28.924	2.406	7.29	28.924
4	1.842	5.583	34.506						
5	1.663	5.038	39.545						
6	1.485	4.5	44.045						
7	1.35	4.089	48.134						
8	1.314	3.981	52.115						
9	1.155	3.5	55.616						
10	1.137	3.445	59.061						
11	1.059	3.205	62.266						
12	0.966	2.928	65.194						
13	0.923	2.797	67.991						
14	0.885	2.681	70.672						
15	0.847	2.566	73.238						
16	0.807	2.444	75.682						
17	0.756	2.29	77.972						
18	0.739	2.241	80.213						
19	0.689	2.088	82.301						
20	0.644	1.95	84.251						
21	0.609	1.847	86.098						
22	0.567	1.718	87.816						
23	0.496	1.503	89.319						
24	0.481	1.456	90.775						
25	0.467	1.414	92.189						
26	0.441	1.337	93.526						
27	0.409	1.24	94.766						
28	0.378	1.147	95.913						
29	0.367	1.111	97.024						
30	0.315	0.956	97.98						

31	0.2 65	0.803	98.783
32	0.2 18	0.661	99.444
33	0.1 84	0.556	100

Extraction method: Principal Component Analysis.

Based on the examination of inherent relationships among the factors under each component, the following interpretations were made to explain the underlining phenomenon linking the factors.

Component 1: Managerial issues

This component identified corruption, difficulty in understanding lean concepts, inconsistency in government policies, poor project definition, lack of equipment and delays in material delivery as major barriers to the implementation of lean construction. The top management of every organization has a major role to play in achieving a successful implementation of innovative strategies (Salem *et al.*, 2005; Hudson, 2007; Bashir *et al.*, 2010). The success of lean practice lies in the commitment of top management in developing and implementing an effective plan and adequately providing the required resources and support to manage changes arising from the implementation (Bashir *et al.*, 2010). Without the support of top management, the professionals involved in construction may face numerous difficulties in adapting the lean construction concept (Kim and Park, 2006; Abdullah *et al.*, 2009). The effect of top management issues on the implementation of lean construction has been well documented and the findings from this research agree well with literature (Common *et al.*, 2000; Alarcon *et al.*, 2002; Forbes and Ahmed, 2004; Alinaitwe, 2009). In order to deal with these managerial issues, the professionals interviewed suggested that management should establish proactive measures to prevent defective production, should ensure timely delivery of materials on site, should train employees on lean concepts and the opinion of employees should be considered in decision making. Other measures suggested include; Government agencies should embark on applicable policies that could provide critical support to make lean methods feasible, Management should monitor inflation risks and pricing levels that could provide the stability that organizations need in order to make lean methods feasible and Management should deal with uncertainties and fears that cause organizations to conceal information instead of sharing it.

Component 2: Technical issues

This component identified incomplete designs, lack of standardization, extensive use of subcontractors, lack of buildable design and lack of agreed implementation methodology as the major barriers to the implementation of lean construction. These barriers are considered technical because they have a direct impact on the success of application of lean construction principles and tools such as reliability, simplicity, flexibility and benchmarking (Bashir *et al.*, 2010). Sub-contractors are mainly responsible for specialists' works. Contractors typically hire sub-contractors who do not have direct contracts with the client. Most sub-

contractors work with inadequate resources and have low expertise, thereby often compromising quality (Forbes and Ahmed, 2004). Poor supervision of sub-contractors may result in lack of solution to critical problems involved in lean construction. Extensive use of sub-contractors who often lack technical expertise constitute a serious barrier to lean construction. Design over-sights and over adherence to standard design solutions can lead to buildability problems or constrain innovation that might offer more cost-effective solutions. Both of these would hold back the industry's desires to develop "leaner" approaches to construction (Construction Industry Research and Association, CIRIA, 2010). The designer is paid to produce a design expressed in the form of specifications and drawings. The contractor is expected to use these as a means of communication, and produce the completed facility. This communication often does not work as well as it should (Forbes and Ahmed, 2004). The problem might be due to the fact that the design lacks buildability and so cannot be interpreted. The effect of technical issues on the implementation of lean construction has been well documented and the findings from this research agree well with literature (Ballard and Howell, 1998; Koskela, 1999; Alinatwe, 2009 and Bashir *et al.*, 2010).

Component 3: Teamwork

This component identified the fragmented nature of the construction industry, lack of long term relationship with suppliers and lack of client and supplier involvement as barriers to the implementation of lean construction. Teamwork can be defined as "cooperative effort by the members of a group or team to achieve a common goal" (Bender and Septelka, 2002). It is common knowledge that various parties in the construction industry work as a team (Abdullah *et al.*, 2009). These team members share the common goal of completing the project to the satisfaction of the client, but because of conflicting and competing interest, a project may suffer from lack of teamwork (Bender and Septelka, 2002). These separate interests are due to the fragmented nature of the construction industry. If these parties are incapable of co-operating among themselves, the implementation of lean construction will definitely be negatively affected as it needs commitment and a strong co-operative network within all parties concerned. The success of lean construction is highly dependent on having a cohesive team working towards congruent goals and objectives. Contractors who purchase materials and services for 70-80% of their turnover (Frodell and Josephson, 2009) should realize the suppliers' part in the delivery and prioritize the value created by the suppliers in order to increase their competitiveness. The lack of long term relationships of construction companies with their suppliers has been attributed to the characteristics of the construction industry (Frodell and Josephson, 2009). The effect of teamwork on the implementation of lean construction has been well documented and the findings from this research agree well with literature (Mossman, 2009; Frodell and Josephson, 2009; Abdullah *et al.*, 2009; Bender and Septelka, 2002; and Bashir *et al.*, 2010).

Suggested measures to overcome barriers to sustainable implementation of LC

The respondents were asked to evaluate the 17 measures identified from literature and confirmed through interviews with professionals. Table 24.3 presents mean scores, standard deviations and rankings of the 17 measures.

Table 24.3 Suggested measures to overcome barriers

MEASURES	MEAN SCORE	STANDARD DEVIATION	RANKING
Management should train employees on lean concepts	4.417	0.594	1
Communication should be improved among players in construction projects	4.365	0.774	2
Construction should ensure or maintain continuous improvement: thus, reduction of costs, increase quality and productivity	4.346	0.658	3
Construction managers should be committed to changes	4.234	0.661	4
Workers should be able to work in teams	4.218	0.788	5
Proactive measures to prevent defective production should be established by firms	4.141	0.680	6
Timely delivery of materials to construction sites	4.134	0.688	7
Firms should understand client needs and expectations and position themselves accordingly	4.131	0.630	8
Companies should be more client focused	4.106	0.878	9
Standardized construction elements should be promoted in the industry	4.080	0.816	10
Firms should be willing to change organizational cultures that do not promote lean construction	4.071	0.807	11
The opinion of employees should be considered in decision making	4.068	0.801	12
Government agencies should embark on applicable policies that could provide critical support to make lean methods feasible	4.067	0.924	13
Management should monitor inflation risks and pricing levels that could provide the stability that organizations need in order to make lean methods feasible	4.061	0.837	14
Management should deal with uncertainties and fears that cause organizations to conceal information instead of sharing it	4.060	0.893	15
Partnering should be promoted to maximize team building and development of trust	4.051	0.923	16
Team members should be empowered in decision-making to	3.923	0.986	17

All the 17 measures have mean ratings of 2.50 or higher and therefore considered significant (Table 24.3). The results show that the five most significant measures to overcome barriers to sustainable implementation of LC in the Ghanaian construction industry are 'management should train employees on lean concepts', 'communication should be improved among players in construction projects', 'construction should ensure or maintain continuous improvement: thus, reduction of costs, increase quality and productivity', 'construction managers should be committed to changes', and 'workers should be able to work in teams'. The findings of this study confirm that in the literature (Bashir et al., 2010). Bashir et al. (2010) stated that steps to overcome barriers to implementation of LC in the UK include taking full advantage of staff training on LC at all levels, engaging skilled site operatives, and promoting the LC concept to companies, professional bodies and major stakeholders. The UK construction industry also engaged in funding workshops and research that could generate more literature to guide LC implementation.

4. CONCLUSIONS AND RECOMMENDATIONS

From 33 factors identified by the Ghanaian building contractors and consultants as potential barriers to the implementation of lean construction, factor analysis enabled 14 of them to be placed under three components: (1) Managerial issues comprising corruption, difficulty in understanding lean concepts, inconsistency in government policies, poor project definition, lack of equipment and delays in material delivery; (2) Technical issues comprising incomplete designs, lack of standardization, extensive use of subcontractors, lack of buildable design and lack of agreed implementation methodology; and (3) Teamwork issues comprising the fragmented nature of the construction industry, lack of long term relationship with suppliers and lack of client and supplier involvement. To ensure the successful implementation of lean construction, management should train employees on lean concepts, ability to work in teams and establish proactive measures to prevent defective production, Construction managers should among others be committed to changes, understand client needs and expectations, and maintain continuous improvement (i.e. reduction of costs, increase quality and productivity. Government agencies on their part should embark on applicable policies that could provide critical support to make lean methods feasible. The identified barriers and possible measures to overcome them should provide an enabling environment for construction practitioners to successfully implement lean construction and improve construction quality and efficiency for the benefit of the client.

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An analysis of the impact of rework on project performance: Views from the field

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ABSTRACT

Purpose: This paper assesses the impacts of rework on construction project performance. In addition it identifies the root causes of rework during the design development process.

Methodology: Case study approaches based on purposively selected projects were used to analyse the impact of rework on project performance. Interviews were conducted with consulting engineering firms to obtain data.

Findings: The findings of this study establish that the impacts of rework are not significantly different between the two projects. Changes initiated by the client and contractors together with design-related sources such as errors and omissions in contract documentation were found to be the primary causes of rework. Particularly in project A rework was exacerbated by changes made at the request of municipality to comply with new fire safety regulation.

Limitations: The study was conducted in Cape Town and limited to two multiple storey educational facilities and as a result the reported findings cannot be generalized. In addition, causal histories for identified rework events tended to be grounded in the views of the design consultants and as result there is a potential for bias to exist. However, the findings reported are akin to what the normative literature has reported.

Value: To reduce the impact of rework on project performance, It is suggests that construction companies and consultant firms (particularly design consultants) need an understanding of its causal structure during the design development process so that effective prevention strategies can be identified and the impact of rework reduced or eliminated.

Key words: causes, construction, errors, omissions, rework, waste.

1. INTRODUCTION

The construction industry has the iniquitous reputation of being fragmented; lacking co-ordination and communication between parties; creating adversarial contractual relationships; and lacking customer focus (Love, Edwards & Smith 2005). This combination of problems has meant that rework has become an insidious problem and so consequently, the costs of rework have been found to be considerable (Love *et al*, 2005). Love, Holt, Shen, Li, and Irani (2002) stated that both the internal and external environments of construction projects are dynamic and relatively unstable. Tasks performed in construction projects are typically divided between professional (e.g. architect, structural engineer, project manager) and trade disciplines (e.g. the contractor's and sub contractors' carpenters, bricklayers, plumbers), which frequently operate independently of one another. Due to the complex characteristics nature of construction, Palaneeswaran (2006) opined that amendments may be deemed inevitable in some instances, however uncontrolled occurrences of rework and wastages should be effectively controlled. Rework is a major contributor to time wastage and schedule overruns which will eventually impact on cost, resources as well as quality (Love & Edwards, 2004). Cooper (1993) stated that rework emerges as overtime, additional hiring of resources such as for example labour and plant, schedule slippage, and reductions in project scope or quality. To date there has been limited research that has sought to determine the impact of rework in South African construction projects. Therefore this paper aims to determine the causes and effect of rework that occur during construction so that effective prevention and reduction strategies can be developed.

2. NATURE OF REWORK

The nature of rework can be determined by referring to their definition /interpretations and classification. According to Love (2002a) rework has various definitions and interpretations within the construction management literature. Terms for it include "quality deviations", "non-conformance", "defects", and "quality failures" (Burati, Farrington and Ledbetter 1992, Abdul-Rahman 1995, Josephson and Hammarlund 1999, Barber, Graves, Hall, Sheath and Tomkins 2000). Love (2002a) defines rework as "the unnecessary effort of re-doing a process or activity that was incorrectly implemented the first time". Similarly, field rework is defined as activities that have to be done more than once or activities that remove work previously installed as part of a project (CII 2001a). In the sense of conformance, there are two main definitions of rework (Love 2002a; Fayek, Dissanayake and Campero 2003). The first definition is that rework is the process by which an item is made to conform to the original requirements by completion or correction (Ashford 1992). The second definition given by the Construction Industry Development Agency (1995) holds that rework involves doing something at least one extra time due to non-conformance to requirements.

Burati *et al.* (1992) used deviation categories based on construction, design, operability, fabrication, and transportation to identify the causes of rework from nine fast-tracked industrial construction projects.

Love, Wyatt and Mohamed (1997) proposed a rework classification system based on three principle groups namely; people, design, and construction. Love and Li (2000) also classified rework in three categories; these include client-initiated changes, nonvariations, and defects.

3. CAUSES OF REWORK

3.1 Engineering and reviews

Love and Li (2000) revealed that, errors and omissions appear to be major factors that contribute to rework. The Building Research Establishment in the UK (BRE, 1981) found that errors in buildings had 50% of their origin in the design stage and 40% in the construction stage. A cited example by Love and Li divulge that the architect's documentation for the ceilings and partitions package contained dimensional errors and missing information, and thus affected the set-out of the internal walls. During construction, rework arose out of incomplete and erroneous information. Every time a change was made in design, it had to be reworked by the design team, which in turn affected their fee (Love and Li 2000, p489).

3.2 Human Resource Capability

Hampson (1997) stated that a major challenge facing today's construction project managers is to encourage innovation throughout the project process to ensure that all problems are easy to identify. Love, Holt, Shen, Li, and Irani (2002) highlighted that a large portion of rework costs is attributable to the poor skill levels of the client's project manager, and of the design team and subcontractors. Fayek *et al.* (2003) identified insufficient skills levels, inadequate supervision and job planning and unclear instructions to workers as some of the factors that contributed to rework in their study titled "Measuring and classifying construction field rework". Another cited example is a study conducted to determine the effect of quality supervision on rework in Indonesia by Alwi *et al.* (2001). The study revealed that the quality of site supervision had a major influence on the overall performance and efficiency of construction projects. Furthermore, Smallwood (2000) conducted a study to investigate clients' perception relative to contractors performance among members of South African Property Owners Association (SAPOA). It was evident that some of the causes of poor contractor performance as perceived by clients were poor management of the design activities, poor management and low skills level among the workers. Alwi et al (2001) stressed that experienced and well-trained supervisors have an important role in minimising the amount of rework due to construction defects.

3.3 Leadership and communication

According to The Business Roundtable (1982) the inability of many supervisors to plan work, communicate with workers, and direct activities adequately is fundamentally linked to increasing amount and cost of rework. Lack of design coordination and integration between project team

members can lead to design deficiencies and exacerbate the causes of rework. Josephson and Hammarlund (1999) have suggested that source of design-related rework is attributable to communication problems. Similarly, Austin *et al.* (1994) pointed out that the ineffective use of information technology in managing and communicating information aggravates the amount of rework that occurs in a project. Love and Li (2000) conducted a study to quantify the causes and cost of rework on construction of residential homes and industrial warehouses. Findings revealed that poor coordination and integration between design team members hindered the flow of information among them. Love and Li (2000) revealed that engineers used CAD technologies and the architects used manual systems to document their designs. As a result, some drawings were issued with dimensional errors and missing information. Walker (1994) concluded that clients and their project team members must communicate and work together harmoniously if projects are to be delivered on or ahead of time.

3.4 Quality management issues

Alwi *et al.* (2001) affirmed that quality management principles and tools are not strongly embedded in conventional construction management practice. As a result, rework, on many cases, is accepted as an inevitable feature of the construction process increasing the likelihood of project time and cost overruns, and ultimately leading to client dissatisfaction. Likewise Jaafari, (1996) asserted that one of the most perplexing issues facing organizations in the construction industry is their inability to become quality focused. As a result sub-standard products and services often emanate, which inadvertently result in rework. Cusack (1992) stressed that projects without a quality system in place typically experience a 10% cost increase because of rework. On the other hand, Love and Edwards (2004) noted that the construction industry development authority in Australia found that the average cost of rework for projects with a quality system was found to be 0.72%.

3.5 Construction planning and schedule

Site management team and subcontractors project success is dependent upon the effectiveness of the main contractor's construction planning efforts (Chan, 1998; Faniran, Love & Li, 1999; Ireland, 1985; Walker, 1994). The Business Roundtable (1982) identified the lack of adequate planning, scheduling, materials management, quality control and quality assurance as critical problems during the construction process. According to Alwi *et al.* (2001) project managers acknowledge that in some cases, the causes of rework might be interrelated or lead to one another. For example, an inexperienced supervisor who makes a mistake in choosing the suitable construction method will certainly affect the construction process. Smallwood (2000) stressed that one of the major causes of poor contractor performance as perceived by clients was poor planning.

4. IMPACT OF REWORK

The occurrence of rework has an adverse impact on project performance. Palaneeswaran (2006) maintained that rework has both direct and indirect

impact on project performance. For instance in poorly managed projects, the gross impacts of rework (that is direct and indirect) could be equal to or even exceed the anticipated mark up/profit margin levels. The author identified the following direct impact of rework on project management transactions. These include: additional time to rework, additional costs for covering rework occurrences, additional materials for rework and subsequent wastage handling; and additional labour for rework and related extensions of supervising manpower. Love (2002b) concluded that rework can seriously affect an individual, an organisation and a project's performance indirectly. At the individual level, stress, fatigue, absenteeism, de-motivation, and poor morale were found to be the primary indirect effects of rework. At the organisation level, Love (2002b) identified reduced profit, diminished professional image, inter-organisational conflict, loss of future work and poor morale as indirect effects of rework. At the project level, work inactivity such as waiting time, idle time and travelling time and end-user dissatisfaction were identified as indirect consequences of rework.

5. METHODOLOGY

An exploratory research approach was adopted to determine the impact of rework on construction project performance. Purposive sampling method was used to select two construction projects based in Cape Town. In Purposive sampling, people or other units are chosen for a particular purpose (Leedy and Ormrod 2005). It is a useful sampling method consisting of receiving information from a sample of the population that one thinks knows most about the subject matter (Walliman, 2005). Romano (1989) suggests that the number used depends on the individual researcher. Semi structured interviews with relevant parties such as design consultants and observations of physical building were used to obtain qualitative data. A framework of questions for the interview was designed to collect information relating to design-related sources of rework, quality management practices of design consulting firms and the impact of rework on overall project performance. The semi-structured questionnaire was sent to respondents via email so that respondents will be informed about the focus of the interview prior to meeting. This assisted the respondents to prepare adequately for the interview in advance. In project A the interview was conducted telephonically due to the unavailability of the respondent. On the other interview conducted for project B was tape-recorded and subsequently transcribed. Also, direct observations were made by the researcher and notes were taken with the aid of a notebook and pen to derive data.

6. CASE DESCRIPTION – PROJECT A

Project A consisted of a two-storey university residential apartment situated in the suburb of Bellville in Cape Town. The total floor area is 3800 m². It contained a total of 200-beds, a communal kitchen, TV room and an open court yard with a landscaped area in the middle. The contract value for the development was R30 million with a contract period of 14 months. The project was procured using a competitive tender with bill of quantities and working drawings, with the client employing an architect as the project manager to act as their development representative. Due to time constrain on the part of the engineers, the researcher sent the framework of questions to the respondent via email. The respondent (structural engineer) also responded via email. A telephonic interview was made as a follow up by the researcher to obtained clarities and further explanation regarding the answers provided by the respondent and this lasted for 20minutes.

6.1 Causes of rework

6.2.1 Design-related sources

According to the structural engineer the contract drawings were not complete at the time of tender because sufficient information was not available from the architect/principal agent and the client. As a result there were some errors and omissions during the design stage which constituted rework.

6.2.2 Changes initiated by parties involved

The structural engineer revealed that changes were made at the request of the municipality which constituted rework to both the design consultants and construction firm. It was communicated by the architect (Principal agent) to the various design consultants and the contractor. An example was the changing of the orientation of the staircase to comply with the municipality's new fire safety regulation. According to structural engineer, at the time the municipality raised that query the foundations has already started. So the contractor ended up breaking the concrete base to remove the starter reinforcement for the staircase and consequently work in that particular area was put on hold to await the new design. The site engineer concluded that the change resulted in the need for additional paving which subsequently affected the civil drawings.

6.3 Effect of rework

The structural engineer indicated that the client has expressed dissatisfaction about the quality of workmanship and progress on site due

to rework. Likewise the consultants are not satisfied with the progress on site because structural engineer stated that time spent on site for meetings and inspection can be spent on other projects which are currently ongoing. The changes initiated by the municipality particularly regarding the staircase had adverse impact on both the design consultants and construction firm. The structural engineer identified de-motivation, fatigue, poor morale and time spent on redesigning the staircase and paving layout as impacts of rework to his firm. The structural engineer also stated that cost incurred by the firm by paying overtime to workers and client dissatisfaction cannot be overlooked. A summary of the impact of rework experienced from the case study for project A can be seen in figure 1.

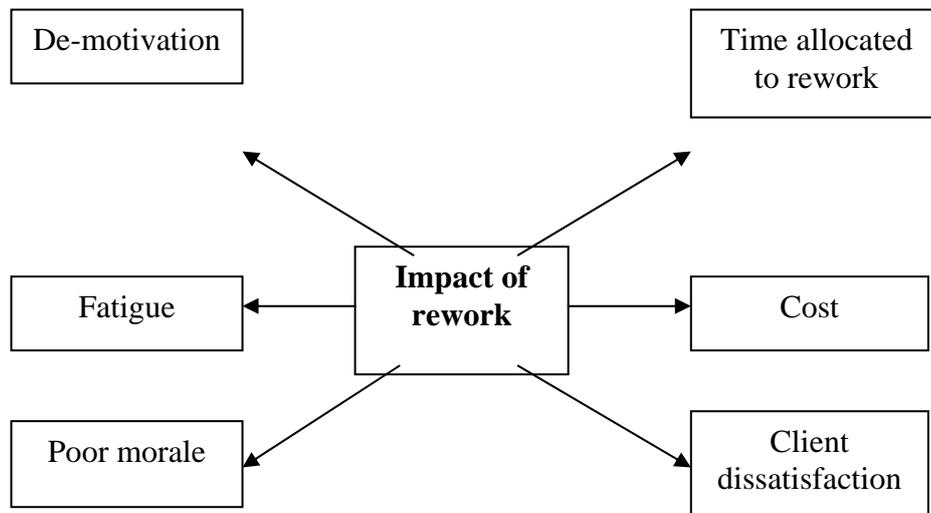


Figure1 Impact of rework for project A.
Adopted from love (2002b)

7. CASE DESCRIPTION – PROJECT B

Project B consisted of a 7-storey educational facility situated in Observatory a suburb of Cape Town. The total floor area was 6000 m². It contained 887 units with en-suite bathroom, 91-kitchens, two-court yards with a central communal area and underground parking are among the facilities incorporated in this development. The project was a competitive tender with bill of quantities, the contract value for the development was R286.6 million with a contract period of 22 months. A project manager was employed by the client to act as their representative. The structural engineer was interviewed on this project. The interview was conducted in the meeting room of the consulting firm and lasted 40 minutes.

7.1 Causes of rework

7.2.1 Design-related sources

The structural engineer admitted that tender drawings and construction drawings are not 100% correct because tender drawings vary a bit from construction drawings. The structural engineer maintained that on this very project there were one or two errors that ensued that constituted rework to design consultants. For instance at the beginning they had a very tight deadlines because there was a fixed time allocated to each task (e.g transfer drawings). Besides, the drawings were not complete at the time of tender. As a result changes were made to the design before the site activities started.

7.2.2 Changes initiated by parties involved

The structural engineer revealed that changes were made at the request of the contractor and subcontractor. One such example cited by the respondent was the subcontractor requested that the warm water storage facility which was designed to be six (6) tanks of 10,000litres each to be changed to four (4) tanks of 13,000litres each. The structural engineer stressed that this resulted in dimensional changes which constituted rework to his firm. Changes were made at the request of the client to increase the room sizes in order to get better value for money. The engineer pointed out that the changes affected the positions of some of the partition walls and subsequently affected that ducting layout and this constituted rework to both the architect and electrical engineering firm.

7.2.3 Construction errors

According to the structural engineer errors were made at the initial stages of the construction phase by the contractor which constituted rework. The engineer stated that those errors were as result of transferability problems, lack of skills and inexperience on the part of subcontractors and lack of proper understanding and inability to interpret the structural drawing

7.3 Effect of rework

The structural engineer stated that rework had serious impact on his firm especially individuals. The engineer stressed that some of the workers who worked on this project were stressed out as a result of working overtime to get the design right. Moreover, morale of the workers was affected and they were de-motivated. Also time allocated for new projects was spent on doing rework. Figure 2 illustrate the impact of rework experienced in the case study for project B.

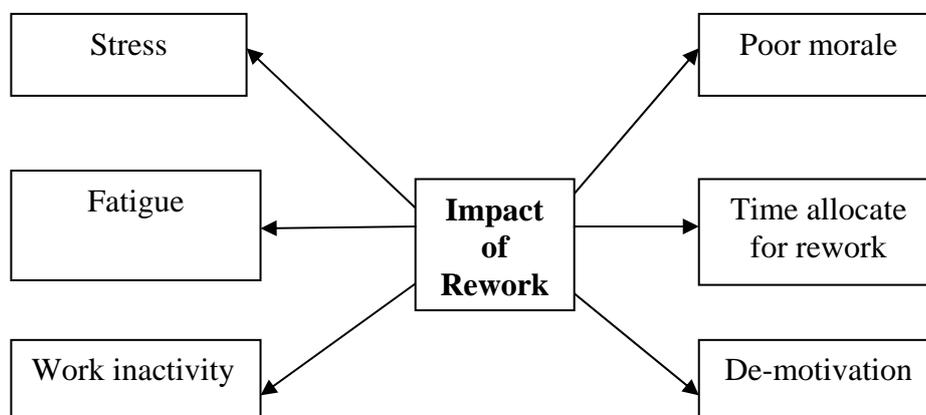


Figure 2 the impact of rework for project B.

Adopted from love (2002b)

8. CONCLUSION

No significant differences in the impact of rework between project A and project B. In both projects it was found that rework was time consuming to design consulting firms. At the individual level poor morale, fatigue, stress and de-motivation were identified as impact of rework. It was also apparent that rework was attributable to changes initiated by the design team and design errors originating from poor detailing. Omissions due to poor coordination and integration amongst design team members and errors during the construction stage were also identified. It was apparent in project A that reworks was exacerbated by changes made at the request of municipality to comply with new fire safety regulation. Therefore understanding of the causal structure of rework are immediate issues that consulting firms need to grapple with in order to reduce design-related source of rework and its impact on construction project performance.

Unless effort is made to improve skills and knowledge, reputation, delays and disruption and loss of profit will become products of rework that arises on-site.

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The exploration of human resource management strategies implemented by architectural practices in order to achieve lean production

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ABSTRACT

Purpose: The purpose of the research is to explore Human Resource Management (HRM) strategies implemented by Architectural practices in order to achieve Lean Production (LP). The research examines strategies by which practices link Human Resource (HR) policies to their production processes in order to elimination waste through improvements in utilisation of human resources.

Methodology: The questionnaire was designed to acquire primary, factual and attitudinal data from architectural practices, secondary data was acquired through a survey of the literature. The scope of the research was limited to the Eastern Cape (EC).

Findings: The literature revealed that it is important for practices to implement effective HRM policies and strategies in order to increase production and process improvements. Survey results revealed that practices need to invest more in training and development of employees. Other findings were that practices were somewhat implementing HRM policies and strategies in their attempt for LP.

Research limitations: The survey was limited to EC architectural practices registered with the Eastern Cape Institute of Architects (ECIA).

Practical implications: This paper revealed that the manufacturing industry places great emphasis on HRM in order to achieve LP. Therefore architectural practices could learn from manufacturing industry's HRM in order to increase their efficiency and productivity.

Value: The paper will be valuable to architectural practices wishing to improve productivity and implement LP by adoption of effective HRM policies and strategies as used in the manufacturing industry.

Keywords: Architectural practices, Human Resource Management, lean production.

1. INTRODUCTION

Many organisations have recognised that the quality of human resources is key to the differentiation and success of organisation; therefore they place tremendous value on the integration of people with organisational objectives, equipment and processes. LP is one of the process improvement interventions that organisations can implement to improve quality and product delivery, while lowering costs associated with product. LP is based on exceptional customer service, collaborative teamwork, operational excellence and respect for workers. Mann (2005) states that a fundamental principle of LP is that workers are assets, and that well trained and motivated workers are the heart of a lean system.

Therefore human capital is one of the most critical components of strategic success of LP, and HRM is a key area. This research explores HRM methodologies and practices used by manufacturing organisation for achieving LP, and compare these with those used by EC architectural practices.

2. LITERATURE REVIEW

2.1 Training and development (TD)

Cherrington (1995) defines TD as a process that enables people to acquire new knowledge, learn new skills, and perform behaviours in a new way. Inyanga (2008) further distinguishes between training and development by stating that training refers to the acquisition of specific skills or knowledge, and development refers to the improvement of intellectual and emotional ability needed to perform better at a specific job. Therefore, investment in TD of employees improves profitability, organisational culture and is integral in the formation of a lean organisation. Liker (2004) postulates that Toyota treats its suppliers as it treats its employees, providing training, and providing cross functional teams to assist suppliers to fix problems so that they can deliver quality products. Liker and Hoseus (2010) note that all Toyota suppliers become part of Toyota's suppliers association, the suppliers meet at regular intervals to share practices, information and concerns.

2.2 Cross-training (CT)

Changing demand for products and services has necessitated organisations to be flexible and this flexibility is possible through training employees to carry out different job functions. Manufacturing industries use CT to provide floor flexibility, Diekmann *et al.* (2004) note that in manufacturing, CT enables planners to distribute work and balance work teams. Calhoon (1999) refers to CT as training workers to perform several parts of the process and operate variety of machines. Womack and Jones (2003) note that cross training a worker gives them the opportunity to learn new skills that stimulate and reduce worker boredom. Therefore CT of workers is an important tool to maximize an organisation's strengths, capabilities, success, and ensures optimum uptake, and lean operations.

2.3 Quality of work life (QWL)

Cascio (2003) notes that quality of work life affects the worker's sense of being, contentment, and productivity. Rethinam and Ismail (2008) define QWL as work environment that is able to fulfil employee's personal needs to provide a positive interaction which leads to improved well-being and productivity. Therefore QWL is associated with an employee's level of positive effect towards job or job situation that enhances quality of work life and improves productivity. QWL is associated with the following aspects: job satisfaction; job involvement, motivation; productivity; health; safety and well-being; job security; competence development; working conditions; working conditions; respect for workers; job design; and balance between work and non-work life.

2.4 Compensation and advancement options

Byars and Rue (1991) note that compensation refers to all intrinsic rewards employees receive for their work. Boxall and Purcell (2003) state that compensation is composed of a basic salary, bonuses, and benefits. Byars and Rue (1991) emphasise that compensation should be: legally adequate; motivating; equitable; provide security; and be cost-benefit effective. Hendry (2003) states that compensation is important because the majority of employee problems are centred on it; and that compensation must fulfil the expectations and aspirations of employees. According to Inyang (2008), attractive compensation enables organisations to attract, retain and motivate competent people. Köster (2007) observes that employees are motivated to perform better when their past performance is rewarded adequately.

2.5 Motivation

When workers are frustrated at work, they cease motivation, this results in poor productivity. Therefore, motivation is a key factor in LP, as it does not only influence quality and productivity, but also contributes to good QWL. Treville and Antonakis (2006) define work motivation as a cognitive state experienced by workers that reflect attributions that individuals make the origins of their actions. Therefore, motivation can be interpreted as coming

from internal influences that cause commitment of workers to given tasks and external influences that cause compliance so that workers perform given tasks. Treville and Antonakis (2006) state that under LP workers are more motivated as they participate in the development of procedures and problem solving, receive feed-back concerning their performance, become part of a team and receive training and equipment to perform their jobs more efficiently.

2.6 Employee Involvement (EI) and Employee empowerment (EE)

According to Cascio (2003), EI occurs when employees are solicited, and are involved in helping the organisation to reach its objectives. Therefore, EI focuses on organising employee's skills and knowledge to improve efficiency and customer service. Hendry (2003) states that EE occurs when employees are given the authority and tools required to continuously improve the organisational performance. Benjamin and Freivalds (1999) note that EE has been implemented in job design and quality of work life programs. Therefore EE means that all employees are responsible and have authority to participate in decision and problem solving in their operation levels.

2.7 Employee Suggestion System (ESS)

ESS is important in LP for continuous improvement and for generation of numerous improvements by employees. Hultgren (2008) notes that there are differences between Kaizen ESS, which is used in Japan, and ESS used in Western countries. He further notes that Kaizen suggestion systems generate numerous small improvements and they force all employees to submit, while the western suggestion systems encourage pursuit of innovation, and are more individualistic and passive. Miller (2003) states that too few companies realise the power and impact of ESS on process improvement. Toyota has realised the impact of ESS, as Liker (2008) alludes that Toyota employees generated over 90 000 suggestions, of which 90% are implemented. Liker (2008), Miller (2003), and Hultgren (2008) state that employees receive remuneration for successfully implemented suggestions that lead to cost savings and process improvement.

2.8 Teamwork (TW)

Pieterse (2007) notes that TW is important for LP as many production initiatives are best undertaken through teams. According to this author TW provides better motivation, co-ordination, more effective problem-solving and decision making. This is substantiated by Heizer and Render (2006) who state that teams play a fatal role in manufacturing and achievement of LP. There are various definitions for the term team:

- Krajewski *et al.* (2007) define it briefly as a small group of people who have a common goal, set their own performance goals and approaches and hold themselves accountable for success;
- Dilworth (2000) defines it as a small number of people with complementary skills who are committed to a common purpose, set their own performance goal and hold themselves mutually accountable, and
- Mullin (2005) defines it as when people have a common goal and recognise that their personal success is dependent on the success of others.

2.9 Leadership and management

House (2004) defines leadership organisationally as the ability of an individual to influence, motivate and enable others to contribute towards the effectiveness and success of an organisation. Bolden (2004) defines leadership as a process whereby an individual influences a group of individuals to achieve a common goal. Liker and Hoseus (2008) differentiate between leadership and management as follows:

- Leadership is a pull system with followers feeling a magnetic pull that compels them to follow the direction of the leader, and
- Management is a push system in which workers are pushed to follow the orders of the managers.

Liker and Hoseus (2008) note that the leader's function is to influence workers and build a shared vision and culture, and that managers are responsible for optimum utilisation of material, plant, and machinery. Liker (2004) emphasizes that unless leaders and managers initiate improvements, create culture, productivity cannot be expected to improve, and Liker and Hoseus (2008) note that LP cannot be maintained without effective leadership.

3. RESEARCH METHOD

The data for this research were collected using primary and secondary sources. The primary data was collected through the use of a questionnaire survey, and secondary data through a survey of the literature. The questionnaire was designed to acquire primary, factual and attitudinal data from EC architectural practices; and was used to determine the acceptance or rejection of the hypotheses. Secondary data used in this study were acquired through a literature review of international and national publications which included conference papers, reports, journals, articles and the Internet. Secondary data were utilised to establish criteria and theories against which empirical research of the primary data was measured.

A quantitative research approach was adopted for the questionnaire survey. The questionnaire survey was conducted in the EC amongst

architectural practices registered with the Eastern Cape Institute of Architects (ECIA). The descriptive statistics in the form of frequencies and a measure of central tendency in the form of a mean score based on the number of responses to a five point Likert type scale were computed using the Microsoft Excel software package. A comprehensive survey of literature was undertaken and was used to establish criteria and theories against which the primary data was compared. Sampling was not used for this study as the questionnaire was sent to all practices.

3.1 Survey results

Questionnaires were distributed to all 38 member practices of the ECIA. Altogether 22 practices responded, which equates to a 58% response rate.

3.2 Training and development (TD)

Respondents were required to indicate the extent to which their practices provide training to employees based on the Likert scale of 1 to 5 where 1 (Strongly disagree) and 5 (Strongly agree). It is notable that a mean score of 3.65 was achieved for providing training programs for employees, 2.48 for investing a percentage of annual business volume in training, and 3.77 for giving employees an opportunity to share knowledge via training sessions, presentations, and team assignments. It is notable that two mean scores are above the midpoint rating of 3.00, which indicates that in general the respondents can be deemed to provide training programs to employees and give employees a chance to employees to share knowledge.

3.3 Cross-training

On the question of career and personal growth of employees through cross-training programs, 67% of respondents indicated that they provide opportunities for cross-training, 77% indicated that employees have the opportunity and are expected to continually develop and upgrade their capabilities, 52% indicated that the workforce flexibility is being continually increased, and 55% indicated that retraining is provided for employees whose skills are no longer needed. The findings indicate that practices undertake cross-training of employees to provide flexibility and job enrichment, which are necessary for LP.

3.4 Quality of work life

Respondents were required to indicate the extent to which their practices provide a good quality of work life to employees based on the Likert scale of 1 to 5 where 1 (Strongly disagree) and 5 (Strongly agree). It is notable that a mean score of 3.70 score was achieved for providing a satisfactory, safe, comfortable and healthy work environment, 3.65 for making sure that workstations are organized with adequate materials and provided tools in their designated places and followed preventative measures in order to increase health and well-being of employees and 3.55 for allowing

employees to suggest ways to improve the workplace environment. It is notable that all mean scores are above the midpoint of 3.00, which indicates that in general the respondents provide a satisfactory quality of work life to employees. The quality of work life is important for increasing productivity, and for worker's positive sense of well-being and contentment.

3.5 Compensation, advancement options and motivation

Respondents were required to indicate the extent to which they agree with the statement regarding the compensation of employees based on the Likert scale of 1 to 5 where 1 (Strongly disagree) and 5 (Strongly agree). It is significant that all the mean scores are above the midpoint of 3.00, which indicates that in general, the majority of practices can be deemed to consider compensation as important in motivating employees. The statement with the highest mean score, namely practices addressing compensation and benefits during hiring processes (3.83), is followed by practices offering attractive and competitive benefits package (3.64). The statement with the third highest mean score is practices recognising excellent performance and linking pay to performance (3.32). Other findings from the survey include the mean score of 3.30 for managers recognising and rewarding employees when they have done a good job and 71% of employees are confident and certain about their organisation's future.

3.6 Employee Involvement (EI), Employee empowerment (EE) and Employee suggestion system (ESS)

Altogether 66% of respondents indicated that employees have considerable opportunity for independence and freedom to do their work, while 63% indicated that employees speak to management when they have work and non-work related problems, and 75% indicated that employees were given an opportunity to coordinate their work with others to complete the whole task. The other findings from the research indicate the extent to which their practices implement ESS based on the Likert scale of 1 to 5 where 1 (Strongly disagree) and 5 (Strongly agree). It is notable that all mean scores are above the midpoint score of 3.00, which indicates that in general, the majority of practices can be deemed to implement ESS. The statement with the highest mean score is practices establishing a reward structure for successful suggestions (3.38), followed by managers supporting reasonable suggestions (3.18). The statement with the third highest mean score is that of managers actively seek feedback from clients and customers with a view to improving service (3.09).

3.7 Teamwork

It is notable that all respondents indicated that practices use teams and encourage teamwork, that team members work hard together to build positive relationships with each other, and that team members share their knowledge and skills openly to grow together. Altogether 90.9% indicated that they use innovative and creative thinking to break through problems

and 81.8% indicated that employees understand how their individual efforts contribute to business success. Other results revealed that 77.3% indicated that team members are mutually supportive, and willingly help each other to overcome problems to achieve success, and 72.7% indicated that management helps to create commitment to common goals among group members.

3.8 Leadership and management

All respondents indicated that management identifies problems, obstacles, and trends that will impact the outcome of initiatives, and all respondents indicated that employees are treated fairly and equitably and that management takes time to meet with new employees to learn about their talents and skills. All respondents indicated that management is quick to deal with problem employees and performance, and that management measures business performance against objectives. 81.8% indicated management can clearly see a pathway for the implementation of a vision, including not only the process, but also the people and resources needed.

4. CONCLUSIONS

An extensive literature survey was conducted to determine which HRM methodologies and practices are used in manufacturing industry to achieve LP. The literature outlined that manufacturing places great emphasis and investment on TD of employees in order to develop lean organisations and lean cultures. It also emphasised that managers and employees need to be involved in TD, and support the role of TD for implementing LP. It was also identified that the manufacturing industries use CT to providing work floor flexibility and to provide job enrichment. Quality of work life in manufacturing industry includes relationship with managers and co-workers, job design, working conditions, and compensation. All three aspects above are important for motivating employees to be productive and contribute to LP. It can be deduced that an optimum work environment is important for employee's well-being, and productivity. The working conditions are not only important for efficiency, but are important for behavioural consideration and workers satisfaction, compensation and advancement option can be assumed to be similar for the manufacturing and construction industry. It can be deduced that compensation and advancement options are key for workers and the organisation. Teams and team development are important aspects of LP and manufacturing industry places great emphasis on the use of teams and team development. It is notable that the consistency of project teams needs to be given considerable attention in construction in order to enable consistency. It is evident that the concepts of leadership are broad and have a variety of meanings; the literature revealed that leadership and management are important for operational excellence and LP.

The following can be concluded from the survey: The majority of respondents indicated that they provide training programs for employees

and further indicated that they invest a nominal amount of annual percentage of business volume in training and therefore it can be concluded that practices were either not training all their employees, or that they are submitting them to inferior training programmes due to the nominal amounts invested in TD. Therefore, an opportunity exists for practices to improve through LP by investing higher amounts of their business volumes to TD. The majority of practices indicated that they provided CT programs for employees, that they continually developed, upgraded and improve employees' capabilities. It can be concluded from the results that the practices focused their attention on creating a comfortable and healthy work environment. The findings indicate that practices are taking compensation and advancement options seriously, this enables practices to motivate employees, which leads to greater productivity. Respondents indicated that employees have opportunity and freedom, and that practices listened and discussed with employees about work and non-work related problems. The majority of respondents also indicated that they implemented an ESS. Practices also indicated that they employed the use of teams and encouraged team work in their organisations. It can be further concluded that managers used lean leadership methodologies for leading and managing their practices. Therefore based on all the survey results, it can be concluded that practices were somewhat implementing HR policies and strategies, similar to those used in manufacturing industry, in their attempt for LP.

5. RECOMMENDATIONS

It is recommended that EC practices should adopt more HRM policies and strategies from manufacturing industry in order to increase staff morale, efficiency, competitiveness and effectiveness for delivery of projects.

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Identifying factors of health and safety (H&S) culture for the construction industry

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ABSTRACT

Purpose:

This paper presents a review of previous studies on the subject of H&S culture and outline key H&S culture factors that are necessary to make the concept useful in the construction industry. A conceptualised model LIP+3C is also presented as the outcome of the review

Design/methodology/approach:

Literature review focused on exploring the conceptual definitions of H&S culture was conducted. A matrix for the identified literature was developed to identify common H&S culture elements.

Findings

It was revealed that there is still confusion and lack of consensus on the concept of H&S culture. However, the H&S culture elements of leadership, involvement, procedures, communication, competence and commitment dominate the literature.

Research limitations/implications:

Literature review was conducted on 15 published peer reviewed journal articles. The validation of the elements found in the study is currently under way although preliminary results confirm the findings.

Practical implications:

H&S culture has been identified as being of great importance to H&S performance improvement. Identifying culture elements that can easily be implemented and understood will contribute to improving the current H&S status.

Originality/value:

Adopting the LIP+3C culture model composed of elements that can easily be implemented and understood will contribute to improving the current H&S status

Keywords: Culture, H&S, LIP+3C, Model

1. INTRODUCTION

Construction H&S performance improvement has in recent years become a priority and thus has gained industry-wide attention (Cheung et al, 2004 and Hamalainen et al, 2009) because of the economic benefits, the need to improve construction industry image, the need for organisations to be socially responsible and the need for an improved general regard and respect for people working in the construction industry. In addition, the legislative pressure coupled with debate concerning the personal responsibility that senior managers should bear for their organisations on H&S failures (Fitzgerald, 2005) has contributed to most organisations to focus on H&S improvement. However improving H&S performance in the construction industry has also proved to be somewhat challenging partly due to the industry's complex nature. Despite this complexity of the industry, H&S performance improvement remains a crucial issue and its importance or need has been demonstrated in numerous studies (Smallman and John, 2001; Lee et al, 2006; ILO, 2003; and Hoonakker et al, 2005).

The need for H&S performance improvement has been recognised and as a result there are many suggestions and approaches for H&S performance improvement that have been proposed. Amongst these proposals are prevention through design (PtD) (Behm, 2005; Hetherington, 1995; Kinnersley and Roelen, 2007; Weinstein et al, 2005; Gambatese et al, 2005; Hecker et al, 2005), continual improvement of safety management systems (Chua and Goh, 2004), addressing H&S culture (Molenaar et al, 2009; Parker et al, 2006; Molenaar et al, 2002), use of incentives and disincentives (Tang et al, 2008), multi-stakeholder involvement (Lingard et al, 2009; Suraji et al, 2006) and behaviour based H&S (Salem et al, 2007).

However, Culture and particularly the H&S culture of an organisation and by extension, the industry has been identified as being at the core of major accidents and incidents (Oil Spill Commission, 2011; Gadd and Collins, 2002; Wiegmann, 2002). There is also a general agreement on the fact that H&S culture can influence or has an impact on H&S performance (Fernández-Muñiz et al, 2007; Choudhry et al, 2007, and Wamuziri, 2006). Despite the above realisation, there is no consensus on the definition of culture and how culture can be measured in order to be useful for H&S performance improvement. Of the 15 definitions reviewed in this study, 12 of them had definitions that differed from one another (Hudson, 1999; Misnan and Mohammed, 2007; IOSH, 2004; INSAG, 1991; Gadd and Collins, 2002; Fitzgerald, 2005; Fernandez-Muniz et al, 2007; Molenaar et al, 2002; Molenaar, et al, 2009; Wiegmann et al, 2002; HSE, 1993; Dingsdag et al, 2006; and CRC, 2001). As a result it seems as though it is this lack of consensus on these issues that could have caused in part a lack of full utilisation of the concept to improve H&S performance improvement in the construction industry.

In this study, a review of literature has been conducted on the concept of H&S culture in order to harmonise the different views. Based on the literature reviewed, a proposition is made that H&S culture can be

measured and used as a performance indicator. From the synthesised views on the concept, factors of H&S culture have been identified so that H&S culture could be operationalised in a practical and useful way.

2. WHY CULTURE (H&S)?

Motivations for H&S culture consideration in pursuing H&S performance improvement are many and these are very clear in literature. Specifically, H&S performance has been attributed to an improvement in the H&S culture of organisations in studies such as that of Chinda and Mohammed, (2008); Baram and Schoebel, (2007); Dingsdag et al, (2006); Fernandez-Muniz et al, (2007) and Dingsdag et al, (2006). A better H&S performance has been associated with a positive H&S culture prevailing within an organisation concerned and indeed the industry (Dingsdag et al, 2006; Molenaar et al, 2002; and Chinda and Mohamed, 2008). The prevailing culture is therefore very important in so far as the improvement of construction worker's H&S is concerned. It is because of this observation that Chinda and Mohamed (2008) rightly argue that it seems that attempts to improve the H&S record will not be fully realised until the H&S culture is improved.

It is therefore not surprising that the achievement of an effective H&S culture is recognised to be a vital element of achieving and maintaining satisfactory standards of H&S performance (Entec, 1999). It is also for this reason that IOSH (2004) contends that it is insufficient for example to provide safe equipment, systems and procedures if the culture is not conducive to healthy and safe working. Major disasters in the world attest to the foregoing. For example a "poor safety culture" was identified as a factor contributing to the Chernobyl disaster by the international Atomic Energy Agency (IAEA, 1986) and recently, the safety culture was questioned by the Oil Spill commission .as they argued that the immediate causes of the Macondo well blowout can be traced to a series of identifiable mistakes made by BP, Halliburton and Transocean that reveal such systematic failures in risk management that they place in doubt the safety culture of the entire industry (2011). To illustrate how other industries regard H&S culture, Flin et al, (2000) observed that the so called 'high reliability' industries such as the Air traffic, petro chemical and Nuclear installations, where significant hazards are present, operating organisations and their regulators pay considerable attention to safety assessment. They noted that these assessments are mainly on leading indicators focusing on safety climate which is a measure or determinant of the prevailing culture, because as stated earlier most of these industries have realised the importance of organisational culture Flin et al (2000).

Furthermore, safety culture of the organisation influences the deployment and effectiveness of the safety management resources, policies, practices and procedures Gadd et al, (2002). Traditionally, attempts to improve workplace H&S concentrated on technical issues and individual human failures. However, from investigations that have been conducted in the past, the role of safety culture has been highlighted. For example, Fennell, (1988) on the investigation into the Kings Cross fire, stated that a cultural change in management was required throughout the organisation. In another investigation, Cullen (1990) concluded on the Piper

Alpha Inquiry that it is essential to create an atmosphere or culture in which safety is understood to be and is accepted as the number one priority.

It has become clear that organisations' vulnerability to safety hazards does not originate from just 'human errors', chance, environmental factors or technological failures alone. Rather, it is the ingrained organisational policies and standards which have repeatedly been shown to be at the centre of the catastrophe Gadd et al, (2002). It is the prevailing culture in an organisation and that is the reason why H&S culture has become important.

3. WHAT IS CULTURE?

Confusion reigns regarding the definition of culture. Culture can be defined as a characteristic set of assumptions, beliefs, values, knowledge, attitudes and symbols shared and held by all members of a group which influences behavioural patterns and perceptions. These can be surfaced through observation and or description of what goes on by those that are part of the organisation (Fernandez-Muniz et al, 2007; Dingsdag, 2006; Australian Government, 2008; Molenaar et al, 2002 and Cooper, 2000). This definition is also summed up by 'the way we do things here' (Cooper, 2000).

It is important to note that there is always some form of culture present in an organisation or industry (Hudson 1999). The only thing is that culture could either be described as positive, negative, a reporting culture, a tolerant culture or any other aspect an organisation so wishes to use to describe the culture. According to Misnan (2007) and Biggs et al (2006), organisational culture exists on a continuum and that organisations can either have a good or poor H&S culture. As H&S culture is a source of influence in determining H&S outcomes, the construct can be a useful tool to manage and further improve H&S outcomes in the construction industry. H&S culture can also be said to be a subset or part of the overall organisational culture (Cooper, 2000; Hudson, 2001; Wiegmann et al, 2002; Wamuziri, 2006). Further, for H&S culture to be operationalised, we have to know what it is made up of or what factors shape or influence it.

4. WHAT ARE THE FACTORS OF CULTURE (H&S)?

Measuring H&S culture is one area where confusion has reigned partly because of the many terms that have been used to describe what constitutes H&S culture. Some studies have referred to the parts which form, shape or make up H&S culture as characteristics (Fitzgerald, 2005 and Hudson, 1999), Indicators (Fernandez-Muniz et al, 2007, Flin et al, 2000), factors (Misnan et al, 2008), determinants (Chinda et al, 2008), elements (Fernandez-Muniz et al, 2007), enablers (Chinda et al, 2008), and attributes of H&S. It is therefore important to know what these terms mean to partly reduce the confusion. The compact Oxford dictionary (2002) defines the identified terms as follows:

1. Attributes: (v) *or attribute is a characteristic quality. An object traditionally associated with a person or thing. It can also be referred to as characteristic or feature.*
2. Characteristic: (adj) *a typical feature or quality of something or somebody. A distinguishing feature*
3. Determinant: (n) *A factor which determines the nature or outcome of something;*
4. Element/content: (n) *A basic part of something. It can also be referred to as component, constituent;*
5. Enabler: (v) *This is from the word enable which is to provide with the ability or means to do something. To make possible.*
6. Factor: (n) *A circumstance, fact, or influence that contributes to a result;*
7. Indicator: (n) *a thing that indicates a state or level.*

A scrutiny of the above terms reveals that the terms 'attribute' and characteristic refer to the description of quality of something. Therefore, with reference to culture this would refer to the quality or an identifying feature say, a reporting culture.

The term 'determinant' and 'factor' refer to a circumstance or aspect that will contribute to a result. Therefore referring to culture, this term would describe an influence that has a bearing on the quality or type of the culture. In other words, without the factor or determinant it is impossible to have the type or quality of culture being sought.

The term 'enabler' on the other hand is more of a catalyst to achieving a result. A type or quality of the culture does not necessarily depend on the enabler but it would be beneficial if it is present.

An 'indicator' is a thing described as being usually an object like a meter, a clock etc. that indicates the level of a result. Therefore with reference to H&S culture, this could be an instrument or certain exhibits from the culture that could be observed or measured to tell the type or quality of the prevailing culture.

This study set out to establish the components and the factors of H&S culture. Having analysed the terms that have been used before in other studies, and also reference being made to the definition of culture, which is a characteristic set of beliefs and values, assumptions, knowledge and attitudes held and shared by all members of a group, culture can be said to be composed or consisted of beliefs, values, assumptions, knowledge and attitudes (IET, 2009; IOSH, 2004; Molenaar et al 2002; and CRC, 2002). These are the aspects that can be referred to as the elements of culture generally and in particular H&S culture. Hudson (1999) correctly refers to two of these, i.e. belief and values as components of a safety culture. From the definition, an element is a part of something or somebody. These elements in turn influence behaviour in all members of a group including influence or contribution to "the way things are done around here".

As for the terms that would refer to aspects that influence H&S culture, the term 'factor' is more appropriate as it entails an aspect or circumstance that

contributes to the result. The term ‘determinant’ could also be used albeit with caution as it suggests more or less the only aspect to influence or determine the outcome.

Many questions surround on how H&S culture could be measured. In other words, to determine what culture is prevalent. In as much as it is desirable to determine or measure the H&S culture, in other words, the beliefs, values, assumptions and attitudes held and shared by a group, undertaking this process to measure culture directly is not easy as it can only be appropriately measured using ethnographic studies (Cooper, 2002). Furthermore, there is still no agreement on the method that can be used to measure culture (Fernandez-Muniz et al, 2007 and Cooper 2002) and continued debate on this is actually not doing well to the concept. It is good to be able to describe and know the prevailing culture in an organisation or industry but it is of no use if this knowledge cannot be translated into actions to improve the status quo.

The argument in this study is that it is much more beneficial, proactive and feasible to operationalise the concept of H&S culture by establishing the factors that contribute or influence H&S culture. Having established these then, efforts can be directed at improving and monitoring these factors. It can be thought of much in the same way as the health of an individual. The health of an individual is dependent on the diet that that individual is following. Following a good healthy diet would result in a better health. In this case, the diet is a contributor or a ‘factor’ and not the only ‘determinant’ to the health of that individual just as exercise is also a contributor. Diet in this case is a leading indicator of the individual’s health. It is certain that a good diet will result in a good health. A Bad diet may result in bad health immediately or after some years. However for positive results, emphasis should be placed on a good diet. Molenaar et al, (2002) illustrate this point by referring to a cholesterol test. They contend that just as a poor cholesterol test does not absolutely predict a heart attack, a poor safety culture test does not indicate an impending accident. However, both are good indicators that a catastrophe is more likely and that some behaviour should be changed. In this example, diet can be described as a factor because it contributes or influences the health of that individual. The task then is to determine these factors that are key to H&S culture and thus be used as leading indicators of H&S culture.

5.0 ANALYSIS

The rest of this section therefore identifies aspects that have been said to influence H&S culture without regard to the term that it was called but rather focus on its active description. Table 1 also lists the various factors that have been identified in the 15 studies that were reviewed in this study.

According to Chinda et al (2008), the aspect of leadership, Policy and strategy of an organisation, people, partnerships and resources, processes and goals are key contributors to H&S culture. In order to change culture, IOSH (2004) contend that there is need for a commitment to change and there has to be leadership at the highest management level. Although he referred to indicators and global components of H&S culture, Wiegmann et

al (2002), identified that organisational commitment and involvement, employee empowerment, a reward system and reporting system contribute to the H&S culture. Specific aspects such as education and training have also been identified as vital aspects to obtain an H&S culture (Fitzgerald, 2005; Pellicer and Molenaar, 2007). In a recent study by Choudhry et al, (2009), 11 factors were identified namely commitment and involvement, procedure, psychological feature, economical feature, self-esteem, workers' experience, performance pressure, working environment, job security and education as having an influence on the H&S culture.

Apart from the above, other factors such as communication (Dingsdag et al, 2006 Gadd et al, 2002; Havold, 2007; Mohamed, 2002; IET, 2009 and IOSH, 2004); competence (Gadd et al, 2002; IET, 2009; IOSH, 2004; Mohamed, 2002), and leadership (Dingsdag et al, 2006; Fitzgerald, 2005; IET, 2009) have also been identified as factors contributing to H&S culture. Risk perception of workers (Gadd et al, 2002; Entec 1999; and Flin et al 2000) and more generally policies, procedures and rules (Flin et al, 2002; Fernandez-Muniz et al 2007 and Mohamed, 2002) have also been identified as factors influencing H&S culture. Perhaps one of the most important factors that has been said to influence culture is the aspect of performance measurement. IOSH (2004), Fitzgerald (2005), Gadd et al (2002), and Pidgeon and O'Leary (2000) all identified this aspect of performance measurement and feedback of results as being one of the influences on H&S culture.

In addition to performance measurement and other factors identified above, the aspect of rewards, incentives and disincentives have also been highlighted as contributing to H&S culture (Wiegmann et al 2002, Molenaar et al, 2009).

The following subcultures have also been identified as components of H&S culture by IOSH (2004):

1. An informed culture;
2. A reporting culture;
3. Fair blame culture where standards are clear as opposed to a no-blame culture which after all is not feasible;
4. Clear expectations from all employees about H&S in terms of values, beliefs, attitudes and practice.

However the above subcultures are too abstract and make measurement or determination of these equally difficult as the overall H&S culture.

Table 1: H&S culture factors

Cultural element	Communication	Leadership	Commitment	Involvement	Competence/Training/talks	Procedures/rules/policy/plans
Dingsdag et al(2006)	X	X			X	X
Havold (2007)	X		X		X	x
Molenaar, Park and Washington (2009)			X	X	X	X
IET (2009)	X	X	X	X	X	X
Booth RT(1995)	X	X	X			X
Glendon & McKenna (1995)	X		X			X
Fitzgerald (2005)	X	X	X	X	X	X
Wiegmann et al (2002)	X		X	X	X	X
Pidgeon and O'Leary (2000)			X			X
Gadd and Collins (2002)	x		X	X	x	X
IOSH (2004)	X	X	X	X	X	X
Entec (1999)	X	X	X		X	X
Parker et al (2006)	X		X		X	X
Flin, Mearns, O'Connor. and Bryden (2000)	X		X	X	X	X
Wamuziri (2006)	X		X			

From the above, factors that were common to all studies disregarding what they were referred to were identified and a consolidated list of factors of H&S culture was drawn. It can be said that the key factors which seemed to influence organisational or industry H&S culture included, (1) leadership (2) involvement (3) procedures (4) commitment (5) communication and (6) competence. These were found to be common to all studies and included indicators which when added together described one factor. An example of this is competence. Competence includes training and capacity to manage. All the six identified factors have been referred to as the LIP+3C model of H&S culture. Indicators of each factor of H&S culture were also identified from literature and are presented in table 2.0.

Table 2: Indicators of factors of H&S culture (adapted from Gadd et al 2002)

Factors	Indicators
Leadership	<ol style="list-style-type: none"> 1. Incorporating H&S considerations at every level of decision making; 2. Having a policy on H&S; 3. Active monitoring of H&S programs; 4. Monitor and control all stakeholders; 5. Coordination of all stakeholders involved
Involvement	<ol style="list-style-type: none"> 1. Extent to which stakeholders get personally involved in critical H&S

	<ul style="list-style-type: none"> activities; 2. Presence and contribution to H&S meetings, planning sessions etc.; 3. Management's contribution to training; 4. Active management oversight of H&S critical operations; 5. Ability of management to stay 'in-touch'; 6. Extent to which there is good communication about H&S issues from and between all stakeholders;
Procedures	<ul style="list-style-type: none"> 1. Monitoring and analysis of H&S implementation; 2. Formal inspections and audits; 3. H&S planning and defined goals; 4. Schedule H&S in prequalification and contracts for all parties; 5. Performance measurement; 6. Established rules, policies and protocol; 7. Having a H&S structure; 8. Hazard identification and risk assessment; 9. H&S design, plan and specification.
Commitment	<ul style="list-style-type: none"> 1. Demonstrating, a positive attitude toward H&S; 2. Actively promoting H&S in a consistent manner across all levels 3. Providing adequate finance and other resources for the implementation of H&S; 4. Supporting the development and implementation of various H&S activities; 5. Demonstrating that effort has been put forth to ensure every aspect of operations, and work schedules are routinely evaluated and modified if necessary; 6. Establishing a reward system for safe behaviour; 7. Conducting regular H&S tours; 8. Getting involved in incident, accidents and ill-health investigations; 9. Deliberately setting H&S as an important agenda item in meetings; 10. Elevating the status of H&S above production and profits.
Competence	<ul style="list-style-type: none"> 1. An organisation having H&S permanent staff; 2. H&S training at all levels; 3. Having H&S knowledge and skills; 4. Conducting induction programs and refresher courses 5. H&S formal qualifications for H&S staff
Communication	<ul style="list-style-type: none"> 1. Formal reporting systems; 2. Formal structured feedback system; 3. Worker involvement in planning and review of H&S; 4. All parties comfortably use the reporting system; 5. Timely and valuable feedback to all parties; 6. Risk findings being disseminated to all concerned; 7. Clear H&S policy statements made by management; 8. Clear statements on expected performance standards regarding H&S; 9. Risk control information being made available to all available; 10. H&S briefings, and or bulletins.

Using a perception or climatic survey of the above indicators at all levels of the organisation or industry, an H&S culture can be characterised. The perception or climate survey can expose the "way things are done" or that "degree of effort" concerning the identified factors (Cooper, 2000 and IOSH, 2004). By looking at the factors that have been identified above, it is possible to build a picture of an organisation and also understand where opportunities for improvement lie. In addition to these climate surveys, some researchers advocate for studies such as focus groups and interviews to supplement the climate surveys in order to understand the behaviour (IOSH, 2004 and Wiegmann et al, 2002).

Improvement of culture can therefore typically follow the plan, do, and check cycle. IOSH (2004) proposes that a maturity model and principles of total quality management combined can be used to build an H&S culture by:

1. Assessing the current level;
2. Developing a plan to move to the next level;
3. Implement the plan;
4. Monitor the implementation of the plan;
5. Re-assess the level for further actions (IOSH, 2004).

It is easier and practical to view the identified factors of leadership, involvement, procedures, commitment, communication and competence as action items that can be used to improve the H&S culture and thus H&S performance. The process of improvement can therefore follow the following stages:

1. Assess LIP +3C;
2. Develop strategies to enhance LIP + 3C;
3. Implement strategies;
4. Assess LIP +3C;
5. Compare with baseline levels to indicate movement;
6. Consult and disseminate information ;
7. Develop strategies to enhance LIP+3C;
8. Repeat process 3-8.

Implementing the LIP+3C has to take cognisance of the external environment factors that can equally have an influence on the H&S culture. According to Cooper (2000), H&S culture does not operate in a vacuum; rather it affects and is affected by the external environment.

6. CONCLUSION

The reason why H&S culture should be considered in the construction industry has been presented. It has been observed that H&S performance improvement is unlikely without the improvement or change in the H&S culture. Only a safe culture can provide any degree of lasting protection (Reason, 2000).

The factors of H&S culture have been identified. It has been noted that the reason, H&S culture has not been utilised to the full has been probably due to the numerous terms that have been used to characterise culture and thus the resultant confusion. In this study, it has been shown that it is beneficial to consider those factors that influence culture and thereafter measure the factors' indicators. This has been described to be more proactive and practical.

The key H&S factors that were found to be common or describe many factors in the studies that were reviewed included leadership, involvement, procedures, commitment, competence and communication which have collectively been referred to as the LIP+3C model of H&S culture.

It has also been shown that the LIP+3C model can be used to both plan for and measure H&S performance. This study has therefore contributed to efforts aimed at improving H&S performance in the construction industry by showing how culture can be operationalised practically.

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IMPACT OF RURAL MIGRANT WORKERS ON CONSTRUCTION HEALTH AND SAFETY (H&S)

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ABSTRACT

Purpose of the study: The study investigates the impact of rural migrant workers on construction health and safety (H&S) in the city of Port Elizabeth.

Design/Methodology/Scope: The study examines the demographic data of the rural migrant construction workers, and the H&S policies and practices of the employers of these workers on site. It also evaluates the H&S training received by these workers and personal protective equipment (PPE) provided by their employers. To achieve these objectives, two questionnaires were compiled; the first was administered workers with the aid of an interpreter, and the second to the site management of the contractors, followed by interviews.

Findings: The data collected was analysed using MS Excel to compute descriptive statistics. From the analysis, the study reveals that the migrant workers are on average 34.8 years old, and the majority of them have no basic education and construction trade qualifications. Furthermore, lack of basic education and construction trade qualifications was a major problem in understanding general and H&S instructions issued by their supervisors. Management commitment to H&S was found to be a critical factor contributing to an improvement in site H&S.

Practical implications: With respect to H&S policies and practices some of the employers provide PPE, such as hard hats, safety boots, and safety goggles, and some conduct weekly H&S meetings. However, the H&S Inspectorate should intensify their effort in enforcing H&S legislation. Contractors should view training and retraining of their workers whether they are permanent or temporary workers, as imperative if they want to undertake construction and make a profit. Furthermore, contractors should budget adequately for H&S, to ensure the sustainability of worker's lives.

Values: Although, researchers have conducted studies on H&S management, and the causes of construction accidents, little attention has been paid to the impact of rural migrant workers on construction H&S in the city of Port Elizabeth. This study provides a contribution to the body of knowledge by presenting a set of recommendations for the H&S inspectorate, and construction firms.

Keywords: Construction, health and safety, rural migrant workers

1.0 INTRODUCTION

Human migration, particularly rural migration has been a challenge (Harris and Moran, 1987). The force of circumstances could be economic, social, political, or religious, causing both the skilled and unskilled to leave rural for urban areas (Vazquez and Stalnaker, 2004). The situation has been exacerbated by cheaper transportation system and the instant world-wide communication through the use of global system for mobile communications (GSM) mobile phones (ILO, 2005 and Bust et al., 2008). Rural migrant workers are able to find out about work through mobile phone contact with relatives and travel to cities at relatively low cost. The Health and Safety Executive (HSE) (2008) maintains that traditionally, construction work is often the most available alternative to farm work, particularly for those without any particular skill or education. Research findings emanating from developing countries have shown that about 47-65% of the construction site workers are rural migrants that were motivated to drift to the cities to earn as much as possible in a short time when they have finished harvesting the crops on farms (HSE, 2006). However, these rural migrant workers have been very helpful to the construction industry. According to Vazquez and Stalnaker (2004), the growing number of rural migrant workers in the construction industry carries a burden as well, namely a rise in work-related injuries and fatalities compared with the rate of fatalities and injuries among the permanent site workers.

Recent H&S statistics in the South African construction industry provided by the Department of Labour (DoL) for the period 2004/05 to 2007/08 show a sharp rise in site accidents up to 2007/08; to about 160 fatalities and 400 non-fatal accidents. The number of fatalities and injuries cases in the South African construction sites is a serious concern (Smallwood, 2004). The Construction Industry Development Board (cidb) (2009) reports that there is poor management commitment to H&S, non-compliance with H&S legislation and the Construction Regulations, as well as inadequate site supervision and poor provision of PPE by employers.

The high number of fatalities and injury cases among construction workers has resulted in suffering and millions of South African Rand has been paid as compensation to injured workers which have a ripple effect on the national economy (cidb, 2009). The frequency of site accidents and incidents and anecdotal evidence that there are a large number of rural migrant workers working in the construction industry engendered this study. Accordingly, the study investigated demographic data of these migrant workers, their province of origin, H&S training received, H&S policies and practices of the employers, and PPE provided by the employers.

2.0 REVIEW OF THE LITERATURE

2.1 Rural migrant site workers

The use of rural migrant workers in construction work is a world-wide phenomenon (Nissen, 2007). Traditionally, rural migrant workers have always been a source of regular and cheap labour to the construction industry in urban centres (Balch and Geddes, 2003 cited in Bust *et al.*, 2008). According to the international Labour Office (ILO) (2005), construction work is often the only significant alternative to farm labour for those without any particular skill or education. A combination of events, however, contributed to the drift of rural migrant workers to the cities such as economic, social, political, or religious (ILO, 2005). Findings by Van Wyk (2003) indicate that almost one in every five black South Africans, aged 20 years or more has not received formal education. He further maintains that this leads the majority of these people into primary industries such as agriculture, mining, and construction, and as a result many are fatally injured, or they experience other classes of injury, and / or disease. Vazquez and Stalnaker (2004) assert that inability to communicate well, and a high illiteracy rate among rural migrant workers compromises site H&S. Nissen (2007) also reports that in South Florida the fatality rate for Hispanic workers has been higher than that for nationals. Similarly, a survey by Torrance (2004) determined that urban immigrant workers in an immigrant community in Northern Virginia faced a high risk of occupational injuries, with adverse outcomes.

The working environment in which these rural migrant workers are exposed to, contributes to workplace injuries and fatalities (Bust *et al.*, 2003). According to the ILO (2005), rural migrant workers are sources of cheaper labour and are invariably employed to do the most dirty, difficult and dangerous work. The economic and social infrastructure facilities available in urban areas however, remain a focal point of attraction to these rural migrant workers with their associated site H&S problems. Therefore, there is the need to understand how to prevent the detrimental effect this has on construction site H&S.

2.2 Effect on construction site health and safety (H&S)

Akindede *et al.* (2009) argue that one of the major effects rural migrant site workers have in the construction industry is visible through non-compliance with site H&S rules and procedures. According to reports from the Department of Labour (DoL, 2007), based on inspections that were conducted in Kwa-Zulu-Natal, Free State, Western Cape, and Gauteng North out of the 412 sites visited, 393 were found to be non-compliant with H&S standards. The common areas of concern were lack of H&S plans, inadequate hazard identification and risks assessment, poor site housekeeping, failure by management to train workers in H&S, and workers not being provided with the necessary PPE

The culture and religion of rural migrant workers can negatively impact on site H&S. A study that investigated the link between religion and H&S culture in South African construction revealed that practicing a religion entails emphasis on the need for conservation of life and the environment (Smallwood, 2004). Similarly, the inability to immediately communicate via

the spoken word on construction sites represents one of the major barriers to successful management of H&S (Hughes and Ferrett, 2008). Nissen (2007) also asserts that the inability to communicate properly has a detrimental impact on workplace H&S, workers morale, and adversely affects production and profits.

Vazquez and Stalnaker (2004) contend that another factor contributing to higher fatality and injury rates among rural migrant site workers is the fact that the rural migrant workers always show some loyalty and respect to their employers, resulting in site accidents and incidents not being reported for the fear of being fired from work. This is one of the factors militating against effective site H&S management. Vazquez and Stalnaker (2004) also contend that rural migrant workers do not like to 'rock the boat' and tend not to report workplace incidents or injuries, unsafe acts or conditions, potential hazards or harassment. Most would rather remain silent and retain their jobs than report problems that could cause them to be negatively viewed by their employer.

2.3 H&S training

H&S training is a very important aspect of site H&S management and H&S culture (Hinze, 2006; Hughes and Ferrett, 2008). This is of particular importance to rural migrant worker with poor education. It is also a legal requirement in terms of the Occupational Health and Safety Act and other regulations, for an employer to provide training and information to employees. In South Africa, Section 8 of the Occupational Health and Safety Act (Republic of South Africa, 1993) specifies that every employer shall provide and maintain, as far as reasonably practicable, a working environment that is safe and without risk to the health of employees. Also, Section 13 (a, b and c) deals with the duty to inform employees of hazards to their H&S arising from any work they have to perform, any article or substance which they have to produce, process, use, handle, store or transport, and any plant or machinery which they are required or permitted to use, as well as the precautionary measures which should be taken and observed with respect to those hazards.

However, there is also a moral reason for H&S training, based on the premise that everyone who is involved in an industrial process has a 'right to know' about hazards associated with their work. H&S training should be applicable to everyone whose H&S could be impacted by the activities of their organisation and should be freely provided in the exercise of the common law duty of care (Hughes and Ferrett, 2008). According to Hinze (2006), training should be at the core of H&S every programme. It is important first to identify the areas in which training is required; the most important training is the induction which takes place on hiring of new workers. This can help the rural migrant workers to know the importance of site H&S rules and procedures. In addition, they will be able to meet other employees and their immediate supervisors. Hinze (2006) and Hughes and Ferrett (2008) maintain that new hired workers to the construction site should receive induction training before starting work, as it has been found that new workers are statistically the most vulnerable to be injured soon after starting work.

2.4 H&S legislation

The South African Construction Regulations (Republic of South Africa, 2003) require a range of interventions relative to clients, designers, and contractors. However, the Construction Regulations place emphasis on hazard identification and risk assessment prior to execution of construction activities (Smallwood and Haupt, 2005).

Clients are required to provide the principal contractor with an H&S specification and any information that may affect H&S, ensure that principal contractors have made adequate allowance for H&S, and discuss the contents of and approve the H&S plan. Designers are required to provide the client with all relevant information about the design, which will affect the pricing of the works, inform the contractor of any known or anticipated danger or hazards, provide the contractor with the methods and sequence of construction, and modify the design where dangerous procedures would be necessary, or substitute hazardous materials.

Contractors are required to ensure that the site is supervised by a competent person who has been appointed in writing and that hazard identification and risk assessments have been carried out. They are also required to take suitable and sufficient steps to prevent, as far as is reasonably practicable, any person from site hazards; not require or permit any person to work under conditions that impose danger to lives.

2.5 Improving site H&S

According to Cordova (2003), efficient communication with rural migrant workers results in fewer workplace injuries and fatalities. She further maintains that it also increases site compliance and reduces employers' workers compensation insurance premiums. According to Chinda and Mohammed (2008), developing a better H&S culture, as well as improved management of H&S on site is essential in order to reduce the number of injuries on construction sites. Ensuring that the workforce is competent to fulfil their H&S responsibilities is another aspect in terms of evolving an optimum organisational H&S culture (Smallwood, 2004). Training plays a key role in the development of these competencies.

According to the ILO (2005), site supervisors play an important role in influencing site H&S performance. Rowlinson (1997) and Rowlinson *et al.* (2003) indicate that poor H&S records are often associated with poor site supervision. Significant improvement is required relative to site planning and layout (Rowlinson, 1997), and also housekeeping (Elbetagi and Hegazy, 2002). There are many accidents due to tripping, slipping, or falling over equipment which has been left lying around, and stepping on nails which have been left projecting from timber (ILO, 2005). Greater attention should be given to the design and selection of tools, equipment and materials (Konz and Johnson, 2004). Hinze (2006) emphasises that H&S should be the paramount consideration, rather than cost, schedule and quality.

3.0 RESEARCH METHODOLOGY

Seven construction firms were randomly selected within the City of Port Elizabeth for the purpose of the study. Five firms were willing to participate in the study - two large, two medium, and one small.

Questionnaires were administered to both rural migrant workers and the site management staff of the five firms. Since most of the rural migrant site

workers were illiterate, interpreters were employed when necessary. The main purpose of the questionnaire was to determine the rural migrant workers' area of origin, H&S training completed and their general understanding of H&S policies and practices. Fifty questionnaires were given out to the site management staff of contractors to be administered to the rural migrant workers and twenty seven were returned. Twenty questionnaires were administered to the management staff of contractors and fifteen were returned. Interviews were also conducted with both rural migrant workers and site management staff of contractors. Leedy and Ormrod (2007), state that an interview is an interaction between two or more people to gain insight relative to problems. The interviews assisted to understand the quality of H&S training received by the rural migrant workers, H&S policies and practices on sites, provision of PPE, and also to investigate its impact on the occurrence of site fatalities and injuries.

4.0 FINDINGS

4.1 Site workers

Table 1 province of origin of rural migrant site workers.

Province	Number	%
Free state	1	3.7
Gauteng	0	0.0
North West	1	3.7
Eastern Cape	16	59.3
Kwa-Zulu Natal	1	3.7
Limpopo	0	0.0
Mpumalanga	0	0.0
Northern Cape	2	7.4
Western Cape	6	22.2
Total	27	100

Table 1 shows that 3.7 % of the rural migrant workers originate from the Free State, 3.7 % from North West, 59.3% from the Eastern Cape, 3.7 % come from Kwa-Zulu Natal, 7.4% from the Northern Cape and 22.2% from the Western Cape. The mean age is 34.8 years, they have lived in Port Elizabeth for an average of 9.5 years, and they have worked for their present employer for an average of 3.9 years. Although, 59.3 % of the respondents are from the Eastern Cape, it is not an indication that they are from the city of Port Elizabeth.

Table 2 Educational qualifications

Level	Number	%
Grade 7	15	55.6
Grade 8	3	11.1
Grade 11	3	11.1
Grade 12	4	14.8
National /Tech	2	7.4
Total	27	100

Table 2 shows that in general the rural migrant workers have low level of education as 55.6 % have grade 7, 11.1% grade 8, 11.1 % grade 11, and

14.8 % grade 12. The interview revealed that those with grade or National / Technical qualifications are not South African nationals.

Table 3 Construction trade qualifications

Trade Qualification	Number	%
Carpenter	6	33.3
Steel erector	2	11.1
Plumber	1	5.6
Bricklayer	1	5.6
Painter	3	16.7
Tiler	1	5.6
Roofer	2	11.1
Electrician	0	0.0
Mason	1	5.6
Water proofer	1	5.6
Total	18	100

However, 66.7% of the respondents have a construction trade qualification, 33.3 % of which are qualified in carpentry, 16.7 % in painting and 11.1 % in steel erecting, and 11.1% in roofing, the other trade qualifications each registering 5.6%. The lack of construction trade qualifications are major factors contributing to poor site H&S. The 33.3 % who have no construction trade qualifications include cleaners, and assistants.

4.2 Health and Safety (H&S) Training

Table 4 Rural migrant site workers' H&S training according to migrant workers

H&S Training	Number	Percentage of	
		Courses	Respondents
Manual handling	4	7.1	14.8
Scaffolding	5	8.9	18.5
First aid	6	10.7	22.2
Hazard identification	6	10.7	22.2
Fire fighting	2	3.6	7.5
Traffic control	2	5.4	7.5
Fall protection	6	10.7	22.2
Back injury protection	2	3.6	7.5
Induction	22	39.3	81.5
Total	55	100	

Table 4 indicates that 81.5% of the rural migrant workers have received induction. However, in terms of the Construction Regulations all workers should receive induction. The next highest percentage was 22.2% relative to first aid, hazard identification, and fall protection, followed by scaffolding (18.5%), and manual handling (14.8%). Hazard identification training is critical as it empowers workers to ensure their personal H&S and that of fellow workers. Only 7.5% of workers had received fire fighting, traffic

control, and back injury protection training. Furthermore, interviews the researcher conducted with some management staff of contractors and randomly picked rural migrant workers on the sites visited, revealed that medium and small size contractors do not place importance on H&S training of workers, with the excuse that their projects are not hazardous. Table 5: Importance of the provision of personal protective safety equipment (PPE) according to rural migrant workers

Type of PPE	MS	Rank
Safety boot	3.80	1
Hard hat	3.60	2
Hand gloves	3.60	3
Hearing protection	3.60	4
Body harness	3.60	5
Eye goggle	3.50	6
Respiratory protection	3.40	7

Table 5 indicates the importance of the provision of PPE according to site management in terms of a mean score (MS) based upon percentage responses to a scale of 1 (not important) to 5 (very important). Given that all MSs are above the mid point score of 3.00, the provision of such PPE can be deemed to be important to site management as opposed to not important. However, none of the MSs are $> 4.20 \leq 5.00$ - more than important to very important / very important.

Table 6: Extent to which practices contribute to poor site H&S

Practices	MS	Rank
Poor hazards identification and risk assessment	4.50	1
Lack of a competent H&S Officer on site	4.40	2
Poor site housekeeping	4.40	3
Lack of toolbox talks	4.40	4
Poor site accident and incident reporting	4.40	5
Lack of management commitment to H&S	4.40	6
Poor provision of canteens	4.40	7
Inadequate bathroom facilities on site	4.30	8
Non display of H&S signs on site	4.10	9
Lack of regular site H&S meetings	4.10	10

Non provision of good drinking water on site	4.00	11
Poor provision of first aid kits on site	4.00	12
Non provision of body harnesses	3.90	13
Non provision of a rest-room on site	3.90	14

Table 6 indicates the extent to which practices contribute to poor site H&S in terms of a MS based upon percentage responses to a scale of 1 (minor) to 5 (major). Given that all the MSs are above the mid-point of 3.00, and that all the practices are phrased in the negative, site H&S can be deemed to be poor. Furthermore, it is notable that the top eight practices have MS $> 4.2 \leq 5.00$, which indicates that, practices / interventions such as poor hazard identification and risk assessment, lack of a competent H&S Officer on site, poor site housekeeping, lack of management commitment to H&S, and lack of toolbox talks can be deemed to contribute to poor site H&S between a near major to major extent / major extent.

4.3 Responses from the site staff of contractors

The contractors' site staff who responded to the questionnaire is on average 34.5 years of age, with an average of 6.5 years experience. 59.9 % of the respondents have a Bachelor degree which indicates that they are well educated and relatively well experienced in the field of construction management.

Table 7: Extent to which factors / interventions could contribute to site H&S improvement

Factor / Intervention	MS	Rank
Management commitment to H&S	4.50	1
Competent H&S Officer on site	4.40	2
Provision of good drinking water on site	4.30	3
Written H&S policy	4.20	4
Worker participation in H&S	4.20	5
Systematic H&S training programme	4.20	6
Toolbox talks	4.20	7
Good housekeeping	4.10	8
Display of H&S signs on site	4.10	8
Provision of first aid kits on site	4.10	8
Hazards identification and risks assessment	4.00	9
Regular H&S meetings	3.90	10
Provision of a site canteen	3.80	11
H&S Committee	3.70	12

Table 7 indicates the extent to which site management rated the contribution of fourteen factors / interventions to an improvement in site H&S in terms of a MS based upon percentage responses to a scale of 1

(minor) to 5 (major). Given that all the MSs are above the mid point of 3.00, all the factors / interventions can be deemed to contribute to H&S improvement. However, three of the fourteen factors/ interventions have MSs $4.20 \leq 5.00$, which indicates that management commitment to H&S, competent H&S officers on site, and provision of good drinking water on site. It is notable that management commitment has been ranked first as it is universally accepted as the critical factor in terms of factors/ interventions contributing to an improvement in H&S. However, a better attitude to H&S management is determined by visible, active commitment from top management (Hinze, 2006).

Table 8: Importance of H&S training to site management

Training	MS	Rank
Induction	4.50	1
Scaffolding	4.30	2
First aid	4.30	2
Fall protection	4.30	2
Hazardous	4.20	3
Back injury prevention	4.20	4
Manual handling	4.10	5
Fire fighting	4.10	6
Traffic control	3.8	7

Table 8 indicates the importance of H&S trainings according to site management in terms of a MS based upon percentage responses to scale of a 1 (not important) to 5 (very important). All the MSs are above the midpoint of 3.0, which indicates that in general the site management can be deemed to view all training as important as opposed to not important. It is notable that induction training is rated between more than important to very important / very important; however, this could be due to the Construction Regulations (Republic of South Africa, 2003), which emphasises the importance of induction to workers. Other training rated similarly is scaffolding, first aid, and fall protection. The high rating afforded H&S training is largely attributable to the two large construction firms that participated in the survey.

Table 9: Extent to which personal protective equipment PPE is provided according to site management

Type of PPE	MS	Rank
Safety boots	4.50	1
Hard hat	4.30	2
Body harness	4.30	2
Hand gloves	4.30	2
Hearing protection	4.30	2
Respiratory protection	4.20	3
Eye goggles	3.80	4

Table 9 indicates the importance of the provision of PPE according to site management in terms of a MS based upon percentage responses to a scale of 1 (not important) to 5 (very important). It is notable that all the MSs are above 3.00, which indicates that the provision of PPE can be deemed

to be important as opposed to not important. It is also notable that safety boots is ranked the highest and that the MS of hard hat is lower than that for safety boots as they are both standard PPE. However, given that the MS of safety boots and other top fives types of PPE, are $>4.20 \leq 5.00$, their provision can be deemed to be between more than important to very important / very important. The provision of respiratory protection and eye goggles in turn can be deemed to be between important to more than important / more than important as the MSs are $> 3.40 \leq 4.20$.

5.0 Conclusions and Recommendations

The South African construction industry is governed by the Occupational Health and Safety Act of 1993 which clearly sets out the duties and responsibilities of employers regarding the H&S of workers. However, from the sites visited it is apparent that the large construction firms have well established H&S programmes as compared to medium and small sized construction firms. It was also determined that medium and small firms tend to ignore H&S regulations because they regard their projects to be less hazardous.

The study revealed that management commitment to H&S, a competent H&S Officer on site, systematic H&S training, good site housekeeping and provision of good drinking water on site are important factors contributing to the improvement of construction site H&S. The recommendations are:

- The government through its Department of Labour H&S Inspectorate should enforce H&S legislation and take proactive measures to ensure that all construction firms adhere thereto;
- Construction firms should: engender management commitment to H&S; educate and train their employees regarding H&S whether they are temporary or permanent worker; discipline individuals who violate H&S rules; appoint H&S Officers, and not consider subcontractors who do not have good H&S records.
- Construction firms should conduct toolbox talks in the language rural migrant workers understand if they do not understand English, and display site H&S signage in such languages where possible, and
- The management of construction firms should demonstrate serious commitment to the H&S of rural migrant workers, as it is not acceptable for workers to be injured on the job and furthermore, remember that completing a job in a healthy and safe manner is more important than merely completing it.

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Critical indicators for measuring health and safety performance improvement in Small and Medium construction Enterprise projects

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ABSTRACT

Purpose

The common measures of measuring health and safety (H&S) performance have, been down stream indicators. Such measures alone are regarded as inadequate in providing meaningful information to help reduce the cause of workplace injury or illness. Researchers have indicated that there is no consensus on what constitutes appropriate H&S performance indicators. This study sought to validate the identified set of leading indicators to enable personnel of small and medium construction enterprises (SME) monitor and improve H&S performance on their projects.

Methodology

The Delphi approach was used where the views of H&S experts were canvassed on 64 potential indicators, categorized into 10 core elements. Consensus was achieved after three successive rounds. The expert's scored each indicator on a 10-point Likert scale of importance where 1=not at all important and 10= very important. They had opportunity to consider their scores informed by the group median score. The scales adapted for consensus were: **strong consensus**, median 9-10, mean 8-10, inter quartile range (IQR) ≤ 1 and $\geq 80\%$ (8-10); **good consensus**, median 7-8.99, mean 6-7.99, IQR $\geq 1.1 \leq 2$ and $\geq 60\% \leq 79\%$ (8-10); **weak consensus**, median ≤ 6.99 , mean ≤ 5.99 and IQR $\geq 2.1 \leq 3$ and $\leq 59\%$ (8-10).

Findings

The key findings indicate that there was a good to strong consensus of 53 indicators. Nine of the indicators had weak consensus. The indicators with weak consensus were from the core elements of appointment of H&S staff one measuring indicators, formal and informal written communication, four

indicators, H&S policy, three indicators and training in H&S, one measuring indicator.

Research limitations

The limitations were, reliance of a structured questionnaire survey in the three successive rounds of Delphi method to reach consensus and experts were not allowed to add any more indicators.

Practical implications

The indicators identified through literature review and validated using Delphi method will enhance H&S performance improvement in SMEs projects.

Originality/value

This study makes contribution to the body of knowledge on the subject where no consensus has been reached pertaining to critical indicators for measuring H&S performance in SMEs project in South Africa. The elements and indicators can further be developed into a structured H&S performance improvement model/framework for SMEs.

Keywords

Critical indicators; health and safety; measuring; performance improvement

1.1 INTRODUCTION

The construction industry is unique as construction activities are performed at outdoor under conditions not conducive for health and safety (H&S). Workers at the construction sites have to face constant changes in the nature of work i.e. the location of work and work with new workers. Most people tend to relate construction industry to a high risk working environment when compared to the other industries (Root, 2005). Further Root, (2005) opines that the reputation of the construction industry relies on the expertise of implementation and managing safety, while meeting the consumer's requirements.

Traditionally, senior managers of most organizations frown upon the management of a workplace where high injury rates are reported. This pre-occupation with outcome performance measures fuels the culture of underreporting of accidents and incidents. Arguably therefore the use of traditional outcome safety measures as a stand alone assessment of workplace safety or as a measure of performance amongst different organizations in the same industry is inherently flawed (Trethewy, 2003). Trethewy (2003) further indicates that the absence of low probability incident does not necessarily mean that core risks are effectively managed but merely that such an incident has just not happened yet.

The above sentiments, advocates shifting from the traditional ways of measuring H&S performance i.e. lagging indicators to leading or positive performance indicators. Therefore the overarching research question is; what are the leading indicators that will influence H&S performance improvement at project level of SMEs?

1.2 Health and safety in South Africa construction industry

The construction 'blitzes' undertaken by the Department of Labour (DoL) determined major non-compliance to H&S legislation, this level of non-compliance as well as the number of fatalities resulted in a scathing attack on the construction industry by Minister Mdladlana, the Minister of Labour (DoL, 2004). Despite isolated reports of improvement, there is very limited commitment to comply with basic requirements, let alone promote a culture of health and safety. Employers view H&S as a cost in the system. It also indicates that small contractors can barely maintain tools and regard safety equipment as luxury items. Even where protective clothing and equipment are provided, workers often avoid their use, including the use of safety goggles and masks when working with grinders and asbestos (Construction Industry Development Board- CIDB, 2004).

The continuing poor H&S performance of the construction industry in the form of fatalities, injuries, and disease, the number of large-scale construction accidents, and the general non-participation by key project stakeholders such as clients and designers, provided the catalyst for promulgation of consolidated construction H&S legislation in the form of the Construction Regulations (Smallwood and Haupt, 2005). Compliance with the Construction Regulations (2003) in South Africa, present significant challenges involving cost, compliance, design and implementation capacity, clients such as the Department of Public Works (DPW) and consultants agree that implementation would require raised understanding on the implications and importance of H&S in the construction industry (CIDB, 2004).

Occupational accidents and diseases impose an enormous cost on South Africa. The DoL, (2007) indicated that construction accidents account for 4% of the global gross domestic product (GDP). Occupational accidents and diseases in South Africa account for approximately 3.5% of its GDP, which, translates to about R30 billion (about US\$4.2 billion). There are other aspects apart from the financial and economic impacts which cannot be measured in any accurate and tangible terms, namely the strain of the loss of a family member, particularly if the worker was the only family bread winner. The most complete accident figures are compiled by the Compensation Commissioner. Construction H&S statistics provided by the DoL covering the period 2004/05 to 2007/08 show a sharp rise in accidents from, 54 fatalities and 159 non-fatal accidents (i.e. temporary or permanent disablement) to around 160 fatalities and around 400 non-fatal accidents respectively (DoL, 2008 cited in CIDB, 2008).

Aside from the direct compensation and medical costs associated with accidents the costs to the economy are immense and include rework, lost time, damage to plant and equipment, disruption, productivity loss and loss of skills to the economy (CIDB, 2004).

These views highlight the importance of identifying and validating H&S leading indicators to be used by SMEs in the South African construction industry at project level to improve H&S performance.

1.3 ELEMENTS FOR H&S PERFORMANCE IMPROVEMENT

According to Fernandez Muniz *et al.* (2007), gaps still remain in the literature, where researchers have conceded rather less importance to measuring the situational characteristics of safety management system (SMS), which Mearns *et al.* (2003) consider to be an integral part of organization's safety culture. Fernandez-Muniz *et al.* (2007) further indicates that there is no consensus of what constitutes the SMS i.e. what the organisation does in H&S management. Mohamed and Chinda (2005) further indicate that there is need to investigate the casual relationship between goal of overall H&S performance improvement and what construction firms actually do on H&S management. This relationship provides an indication of the potential for H&S performance improvement. Ng *et al.* (2003) developed a framework for evaluating the safety performance of contractors in Hong Kong at both the organization level and project level. The factors identified by the researchers for project level were: project management commitment, hazard management, information, training, and promotions, but to name a few. The factors for organization level were administrative and management commitment, H&S training, selection and control subcontractors, safety review; accident record and legislation, codes and standards.

Critical elements influencing H&S performance, that have been replicated in most literature are management commitment and employee involvement and they appear to be easily demonstrated and promoted through risk assessments, inspections, audits, training, hazard reporting and completing corrective actions (Fernandez Muniz *et al.* 2007). Few studies have focused on H&S elements tailored towards SMEs which makes this study important. Based on the above discussions this research identified 64 potential indicators and categorized them into ten core elements viz.; appointment of H&S staff, formal and informal written communication, formal and informal verbal communication, H&S resources, project planning of H&S, project supervision, training in H&S, upper management commitment to H&S, policy on H&S and worker's/employee involvement. The identification of these elements and indicators is beyond the scope of this research work due to the number of pages required. A full complimentary paper can be obtained from the authors, which will be presented in the West African Built Environment Researcher conference in Ghana 2011.

1.4 PROBLEM STATEMENT

The problems and challenges faced in South Africa construction industry on H&S by SMEs needs to be addressed. So far there has been little research on leading indicators that can be more closely tied to the H&S culture or H&S management of SMEs at project level in South Africa. In order to get a better understanding, there is a need to identify important positive performance indicators (PPI) that will improve H&S performance of SMEs at project level, hence reducing accidents, injuries, fatalities and illnesses in their projects. In order to answer the overarching research question stated above, this paper delves into the following specific objectives;

- To assess the characteristics of the experts; and

- To determine the important positive performance indicators to be used for measuring health and safety performance improvement at project level of SMEs.

1.5 METHODOLOGY

An extensive systematic literature review was conducted in journal articles, conference proceedings and relevant H&S books from 1976 - 2010. A list of 64 leading indicators, were then identified. The leading indicators were categorized into ten core elements. The elements and indicators were used to develop a Delphi questionnaire. A panel of experts were selected and took part in a three round of Delphi process. The experts rated the indicators on a 10 point Likert scale of importance, the importance scale, where 1&2 = *unimportant*, 3&4 = *slightly important*, 5&6 = *neutral*, 7&8 = *important*, 9&10 = *very important*.

In order to qualify as an expert the following had to be fulfilled, each individual was required to meet at least three of the following minimum requirements: 1) minimum five years of work experience in either academia or industry; 2) at least one professional qualification: 3) an editor, book, or book chapter authorship, 4) minimum qualification for industry practitioners diploma and academics bachelor degree: 5) five or more publications in conferences and journals, 6) member or committee chair of faculty, 7) safety association member and 8) offers workshop or training in H&S. This is more stringent criteria than the recommended number of at least two by (Rodgers and Lopez, 2002). 20 experts both academics and industry practitioners of H&S agreed to participate; they were selected globally and consented to the introductory questionnaire survey via e-mail, sixteen experts finished all the three rounds. Optimal sample size in research with the Delphi technique has not been established but research has been published based on samples that vary from 10 and 50 to much larger numbers as indicated by (Campbell and Cantril, 2001).

In the first round the experts were asked to rate the importance and the impact of the indicators to the improvement of H&S at project level of SMEs projects. The second and third round of the Delphi questionnaire included a qualitative component that offered experts the opportunity to provide additional feedback in the form of written comments. After round 2 and round 3, the degree of consensus achieved in the Delphi process was assessed by calculating the group median, mean, percentage of respondents rating of between 8 to 10 on importance and inter-quartile range. The group median was used as a feedback to the experts in the successive rounds.

Each round built on responses to the former round. Experts were provided with a summary of the series of rounds. This summary included the feedback to each expert: his or her own score on each item, the group median ratings, and a synopsis of written comments. The experts were then asked to reflect on the feedback and re-rate each indicator/action in light of the new information. The scales of consensus adapted for this research were: **strong consensus**, median 9-10, mean 8-10, inter quartile range (IQR) ≤ 1 and $\geq 80\%$ (8-10); **good consensus**, median 7-8.99, mean 6-7.99, IQR $\geq 1.1 \leq 2$ and $\geq 60\% \leq 79\%$ (8-10); **weak consensus**, median ≤ 6.99 , mean ≤ 5.99 and IQR $\geq 2.1 \leq 3$ and $\leq 59\%$ (8-10).

The Delphi technique has four important features. First it is characterized by its anonymity, thus encouraging honest opinion free from group pressure (Jones and Hunter, 1995). Second iteration allows experts to change their opinions in subsequent rounds. Thirdly, controlled feedback illustrates the distribution of the group's response, in addition to individual's previous response. Finally the Delphi technique can be used to engage participants who are separated by large distances because it can be distributed by mail or online (Hasson *et al.*, 2000). This method was therefore appropriate in validating the leading indicators identified. The limitation to this modified Delphi method is that experts were not allowed to add any core elements or indicators.

1.6 RESULTS

1.6.1 Characteristics of the expert's panel

20 potential experts fulfilled the proposed criteria, but sixteen experts finished all the three rounds of the Delphi study. The experts were internationally recruited and voluntarily accepted to participate in this onerous task. The array number of experts is from Australia (6), America (1), South Africa (7), Italy (1), Portugal (2), Ireland (1), Scotland (1), and Pakistan (1). 95% of experts were male, the female experts who were invited to participate declined the invitation hence the result indicates that construction industry is still male dominated. The sixteen experts who completed the three rounds of Delphi, eight had PhDs, five with master's degree, one with bachelor degree and two with diploma. The accumulated industrial experience of the experts is 118 years at an average of 7.38 years and academic experience of 95 years at an average of 5.94 years. The experts especially the academics have extensively contributed to the body of knowledge on H&S with vast publications in peer reviewed conferences and journals. The experts are professionally registered in their countries.

1.6.2 The important leading/positive performance indicators

Table 1.1 Important indicators to measure H&S performance improvement

<i>Health and safety core elements and indicators</i>	<i>IQR</i>	<i>%(8-10)</i>	<i>Mean</i>	<i>Median</i>
Appointment of H&S staff				
Employing at least one qualified manager with H&S training to oversee H&S on multiple projects	2.00	69	7.75	8.00
At least one staff member with H&S training is employed on each project	2.00	63	7.75	8.00
Employing at least one H&S representative on each project	3.00	44	7.06	7.00
Formal and informal written Communication				
Provision of written information about H&S procedures	3.00	63	8.19	8.50
Provision of written information about the	2.50	56	7.63	8.00

correct way to perform tasks				
Written circular/brochure that informs workers about the risks associated with their work	2.25	50	7.56	7.50
Written circular/brochure that inform workers about the preventive measures to reduce risk	2.25	50	7.50	7.50
Formal and informal verbal communication				
Provide clear verbal instructions to both literate and illiterate employees about H&S	1.00	100	9.44	9.50
H&S information verbally communicated to workers before changes are made to the way their work activities are executed	2.00	100	9.06	9.00
Organize regular meetings to verbally inform workers about the risks associated with their work	2.00	94	8.63	9.00
Organize regular meetings to verbally inform workers about the preventive H&S measures of risky work	2.00	94	8.69	9.00

Scales adapted: *strong consensus*, median 9-10, mean 8-10, inter quartile range (IQR) ≤ 1 and $\geq 80\%$ (8-10); *good consensus*, median 7-8.99, mean 6-7.99, IQR $\geq 1.1 \leq 2$ and $\geq 60\% \leq 79\%$ (8-10); *weak consensus*, median ≤ 6.99 , mean ≤ 5.99 and IQR $\geq 2.1 \leq 3$ and $\leq 59\%$ (8-10).

Continued Table 1.1 Important indicators to measure H&S performance improvement

<i>Health and safety core elements and indicators</i>	<i>IQR</i>	<i>%(8-10)</i>	<i>Mean</i>	<i>Median</i>
H&S resources				
Provision of personal protective equipment (PPE)	1.00	100	9.31	9.50
Training in H&S through attending seminars/workshops	1.25	88	8.50	8.50
Material schedule data sheets provided for all hazardous materials on site	1.75	75	8.06	9.00
Employing technically skilled employees with H&S training	1.00	94	9.13	9.00
Adequate information brochures given on H&S	1.50	69	7.60	8.00
Provision of a budget for H&S	1.00	100	9.50	10.00
Provision of correct tools, equipment and plant to execute construction	2.00	100	9.19	9.50
Provision of good welfare facilities such as showers, canteens, toilets	2.00	94	9.06	9.00
Project planning of H&S				
Ergonomics is considered when deciding the method of construction	2.00	100	9.06	9.00
Reengineering is considered to reduce hazards	2.00	94	9.00	9.00
When head office decides on the method of construction H&S is included in decision making process	1.00	94	9.13	9.00
Each project has a site-specific H&S plan	1.00	94	9.19	9.00
Layout of the site considers H&S aspects	1.00	100	9.38	9.00
Use hazard identification procedures	1.00	100	9.13	9.00
Use of risk assessment procedures	2.00	94	8.69	9.00
Constructability of project is reviewed	1.25	88	8.69	9.00
Scheduling for H&S	1.25	94	9.06	9.00
Project supervision				
Proper supervision by staff trained in H&S	2.00	81	8.44	9.00

Identification of hazards by at least one staff member trained in H&S	1.25	88	8.63	9.00
Results of inspections discussed at H&S meetings	2.00	94	9.00	9.00
H&S inspections done at least daily	1.50	75	8.44	9.00
Local authorities and H&S enforcement agencies visit sites for inspection	2.00	81	8.63	9.00
Ad hoc informal H&S inspections of work place	1.25	81	8.56	9.00
Regular H&S audits of projects	1.25	88	9.00	9.00

The data is based on a ten-point Likert scale of importance, where 1&2 = *unimportant*, 3&4 = *slightly important*, 5&6 = *neutral*, 7&8 = *important*, 9&10 = *very important*

Continued Table 1.1 Important indicators to measure H&S performance improvement

<i>Health and safety core elements and indicators</i>	<i>IQR</i>	<i>%(8-10)</i>	<i>Mean</i>	<i>Median</i>
Training in H&S				
Workers undergo induction on H&S before commencing work on a particular site	1.00	94	9.31	9.50
Workers trained in proper care and use of personal protective equipment	1.25	88	8.94	9.00
Workers are regularly trained in H&S	1.00	88	8.94	9.00
Instruction manuals or safe work procedures are used to aid in preventive action	2.25	75	8.25	9.00
Workers are given time off for training	1.50	75	8.06	8.00
Upper management commitment in H&S				
Managers encourage and support worker participation, commitment and involvement in H&S activities	1.00	94	9.31	9.50
Managers encourage and support training of employees in H&S	1.00	94	9.19	9.00
Managers communicate regularly with workers about H&S	1.00	94	9.44	10.00
Managers actively monitor the H&S performance of their projects and workers	1.00	94	9.38	10.00
Managers take responsibility for H&S	0.25	94	9.63	10.00
Managers actively and visibly lead in H&S matters	1.00	94	9.50	10.00
Managers regularly visit workplaces to check work conditions or communicate with workers about H&S	1.00	94	9.38	10.00
Managers encourage and arrange meetings with employees & other managers to discuss H&S matters	1.00	94	9.31	9.50
Managers conduct toolbox talks themselves	1.25	88	8.63	9.00
Managers ensure that the H&S budget is adequate	1.00	94	9.31	9.50
Managers recognize and reward outstanding H&S performance of workers	1.25	88	8.75	9.00
H&S policy				
Proper implementation of safety management system	2.25	75	8.31	9.00
Company has H&S policy	2.25	75	8.25	8.50
Written in-house H&S rules and regulations for all workers reflecting management concern for	2.25	63	7.75	8.00

safety, principles of action and objectives of achievement The firm coordinates its H&S policies with other human resource policies to ensure the well-being of workers	1.50	75	8.25	8.50
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Continued Table 1.1 Important indicators to measure H&S performance improvement

<i>Health and safety core elements and indicators</i>	<i>IQR</i>	<i>%(8-10)</i>	<i>Mean</i>	<i>Median</i>
Worker/employee involvement in H&S				
Workers are involved in production of H&S policy	2.00	100	9.06	9.00
Workers provide written suggestions on H&S	1.25	81	8.56	8.50
Workers kept informed of provisions of H&S plan	1.25	94	8.81	9.00
Workers are involved in H&S inspections	1.25	100	8.94	9.00
Workers are consulted when the H&S plan is compiled	2.00	88	8.81	9.00
Workers are involved in development of H&S rules and safe work procedures	2.00	94	8.88	9.00
Workers have the explicit right to refuse to work in potentially unsafe, unhealthy conditions	1.00	100	9.38	9.50

The scales adapted: **strong consensus**, median 9-10, mean 8-10, inter quartile range (IQR) ≤ 1 and $\geq 80\%$ (8-10); **good consensus**, median 7-8.99, mean 6-7.99, IQR $\geq 1.1 < 2$ and $\geq 60\% \leq 79\%$ (8-10); **weak consensus**, median ≤ 6.99 , mean ≤ 5.99 and IQR $\geq 2.1 \leq 3$ and $\leq 59\%$ (8-10).

Table 1.1 indicates the results for round 3 of Delphi survey. A total of 62 indicators were rated, two were discarded after round 2 because of ambiguity and were merged. Fifty three indicators had a good to strong consensus whereas nine indicators had weak consensus. Indicators with weak consensus had IQR $\geq 2.1 \leq 3$ or percentage rating of between, 8 to 10 for importance was less than 59%.

The indicators with weak consensus or central tendency were; the employment of at least one H&S representative on each project these was categorised under appointment of H&S staff element. The other element that had indicators with weak consensus was formal and informal written communication. These indicators were; provision of written information about H&S procedures, provision of written information about the correct way to perform tasks and written circular/brochure that inform workers about the preventive measures to reduce risk as indicated in Table 1 these indicators fulfilled the consensus for importance based on their mean and median.

H&S training element had one indicator with weak consensus i.e. instruction manuals or safe work procedures are used to aid in preventive action. Lastly H&S policy had three indicators with weak consensus they were; proper implementation of safety management system, company has H&S policy and written in-house H&S rules and regulations for all workers reflecting management concern for safety, principles of action and objectives of achievement, there IQR were $\geq 2.1 \leq 3$. The result in Table 1.1

further indicates that there was good to strong consensus of 53 indicators. All eleven upper management commitment indicators attained strong consensus based on their mean, median, inter quartile range and percentage of respondents who rated the indicator, between 8 to 10 importance ratings. This was followed by employee involvement indicators the seven indicators attained good consensus to strong consensus hence the experts agreed that these indicators will improve health and safety performance. 20 indicators attained strong consensus with managers taking responsibility of H&S highly rated to improve H&S performance, its IQR was 0.25.

1.7 DISCUSSIONS

This is the first reported study to develop a set of positive performance indicators specifically designed to evaluate early warnings in H&S performance within SMEs to improve their H&S performance at project level in South Africa. These measures are relevant for all SMEs in the construction industry to assist them in improving their H&S performance. It is interesting to note that between formal & informal written communication and formal and informal verbal communication experts have indicated a good to strong consensus for verbal communication than written communication. SMEs managers need to conduct more tool box talks to ensure the information is communicated appropriately, especially providing clear verbal instructions to both literate and illiterate employees on H&S.

It's quite evident from the results that upper management indicators are considered important this result correlates with the study of (Fernandez-Muniz et al., 2007). It is also interesting to note that material schedule data sheet (MSDS) is indicated as important and achieved a good consensus from the experts. This is a step in the right direction because of the different types of materials that contain hazardous chemicals, it is vital for the parties using these materials to know their effect on their health, as some of them have long term effect on employees' health.

1.8 CONCLUSIONS

Majority i.e. fifty three (53) leading indicators attained a good to strong consensus while nine indicators had weak consensus. The limitations of the study were the reliance of a structured questionnaire survey in the three successive rounds of Delphi method to reach consensus and experts were not allowed to add any more indicators. The elements and indicators can further be developed into a structured H&S performance improvement model for SMEs.

The researchers are advocating for a fourth round of Delphi to ensure a thorough consensus of the leading indicators that had weak consensus based on their IQR in order to eliminate the varied dispersion of respondents.

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Conceptual model of client health and safety (H&S) Culture

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ABSTRACT

Purpose: This paper presents a conceptual six factor client H&S culture model referred to as the LIP+3C. The factors *leadership, involvement, procedures, commitment, communication* and *competence* were theorised to explain the client H&S culture construct. The postulated model is based on theory obtained from literature as well as from a Delphi research. H&S culture has been recognised as the feasible way to improve H&S performance in the construction industry.

Design/methodology/approach: A Delphi study as well as a synthesis of literature was conducted and resulted in a theorised conceptual model. To validate the model, a questionnaire survey with a response of 281 was conducted. Findings from the questionnaire survey were analysed using Structural Equation Modelling (SEM) with EQS version 6.1 software.

Findings: The six factor client H&S culture model was found to be well fitting to the sample data through the confirmatory factor analysis. Consequently client H&S culture findings were that client culture could be explained by the level of *leadership, involvement, procedures, commitment, communication* and *competence*.

Research limitations/implications: The size of the sample may affect the generalisability the findings in view of the complexity of the model.

Practical implications: The proposed model in this study makes it possible to determine and predict the client H&S culture. The indicator variables can be used as check items for performance measurement and thus operationalize the concept of H&S culture.

Originality/value: Adopting the LIP+3C culture model composed of elements that can easily be implemented and understood will contribute to improving the current H&S status

Keywords: Conceptual, culture, health and safety, improvement, LIP+3C, Model, performance.

1. INTRODUCTION

Literature has shown that the construction industry's H&S performance leaves much to be desired (Bomel, 2001; CIDB, 2008; and McDonalds et al, 2009). As a result, the construction industry is in dire need of improvement in terms of H&S performance (ILO, 2003).

Various improvement methods have been suggested to improve H&S performance in the industry, however it seems the most feasible way to improve H&S performance in the industry is through a culture change (Riley et al 2001; Baram, 2007; Chinda, 2007). However despite a general agreement that H&S improvement may only be realised with an improvement in the H&S culture, the concept of culture and in particular H&S culture is still a confusing concept. This has resulted in a myriad of definitions and measurement methods of the concept. In addition, there is no agreement on the factors of H&S. Despite these differences on what culture is, what the factors of H&S are, and how it should be measured, there is a general agreement on the efficacy of the concept to improve H&S performance (Dingsdag et al, 2006); (Molenaar et al, 2002; Chinda et al, 2007). It is in fact suggested that clients' culture could offer an opportunity for addressing the problem of H&S performance (Bomel, 2001). It has been suggested that the impetus for change lies with the clients of construction projects because clients can influence contractors' H&S performance.

In this study therefore, a six factor client H&S culture model has been proposed and validated through structural equation modelling in order to operationalise it in the construction industry.

2. CONCEPTUAL MODEL

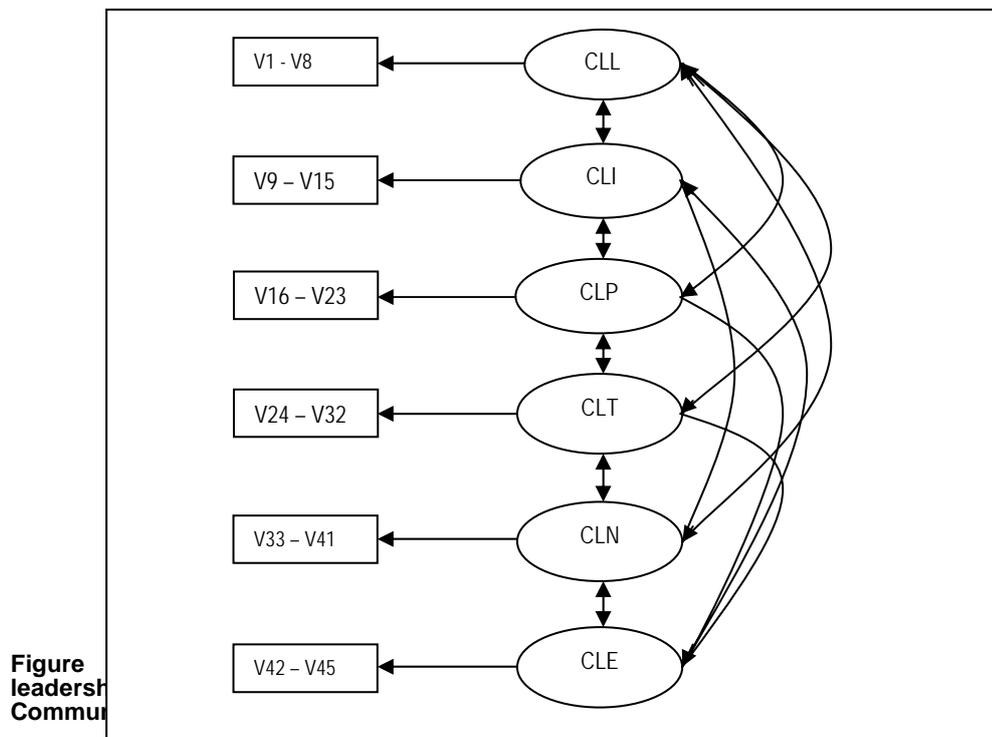
The theory behind the conceptual model presented in the next paragraph, was drawn from literature. The factors comprising the postulated model were aspects that have been said to influence H&S culture and no regard was made to the term/s used to describe them but rather focus was placed on its active description.

According to Chinda et al (2007) the aspect of leadership, Policy and strategy of an organisation, people, partnerships and resources, processes and goals are key contributors to H&S culture. In order to change culture, IOSH (2004) contend that there is need for a commitment to change and there has to be leadership at the highest management level. Although he referred to indicators and global components of H&S culture, Wiegmann (2002) identified that organisational commitment and involvement, employee empowerment, a reward system and reporting system contribute to the H&S culture. Specific aspects such as education and training have also been identified as vital aspects to obtain a H&S culture (Fitzgerald, 2005; Pellicer and Molenaar, 2007). In a recent study by Choudry et al (2009), 11 factors were identified namely commitment and involvement, procedure, psychological feature, economical feature, self-esteem, workers' experience, performance pressure, working environment, job security and education.

Apart from the above, other factors such as communication (Dingsdag et al, 2006; Gadd, 2002; Havold, 2007; Mohamed, 2002, IET, 2009 and IOSH, 2004); competence (Gadd, 2002; IET, 2009; IOSH, 2004; Mohamed, 2002), and leadership (Dingsdag, 2006; Fitzgerald, 2005; IET, 2009) have also been identified as factors contributing to H&S culture. Risk

perception of workers (Gadd, 2002; Entec 1999; and Flin, 2000) and more generally policies, procedures and rules (Flin et al, 2002; Fernández-Muñiz, 2007 and Mohamed, 2002) have also been identified as factors influencing H&S culture. Perhaps one of the most important factors that has been said to influence culture is the aspect of performance measurement. IOSH (2004), Fitzgerald (2005), Gadd (2002), and Pidgeon and O'Leary (Pidgeon, 2000) all identified this aspect of performance measurement and feedback of results as being one of the influences on H&S culture.

From the above (1) leadership (2) involvement (3) procedures (4) commitment (5) communication and (6) competence were identified to be factors of client H&S culture. These were found to be common to most studies. The H&S culture factors have been referred to as the LIP+3C model of H&S culture in this study. The diagrammatical presentation of the model is presented in figure 1.0.



3. FINDINGS

A questionnaire survey was conducted on selected construction projects in South Africa and Botswana. A sample of 281 responses was realised. Analysis of results was conducted through SEM using EQS version 6.1

software. The number of cases that were analysed was 273 cases from a sample of 281 because eight cases were skipped as they had missing variables. The client H&S culture scale had 19 dependent variables, 25 independent variables and 53 free parameters. The number of fixed nonzero parameters was 25.

The hypothesis to be tested was that Client H&S culture is explained by the factors; leadership, involvement, procedures, commitment, competence and communication.

3.1 Residual covariance analysis

In order to establish how well the model fit the sample data and the strength of the hypothesised relations between variables, results presented on residual covariance matrix, distribution of standardised residuals, fit statistics and statistical significance at probability level of 5% were examined.

The residual covariance matrix for both un-standardised and standardised are reported. Results show that all the absolute residual values and the average off-diagonal absolute residual for both un-standardised and standardised were very much close to zero. The smallest un-standardised average off diagonal residual was 0.0076 whilst the largest was 0.0445. Similarly, the smallest standardised average off diagonal residual was 0.0068 whilst the largest was 0.0392. In order to suggest that the model describes the sample data well, the residual values should be very small and evenly distributed. Byrne (Byrne, 2006) suggests that a value can be said to be large if it is greater than 2.58. Therefore since the values in the current study presented in table 1 were all less than 2.58, they were suggestive of a good fit to the sample data. In addition, an average of 97.41% of standardised residuals fell between -0.1 and +0.1. In another analysis of the whole client H&S culture with parcels, results were that 100% of the standardised average absolute residual fell within the -0.1 and +0.1 range indicating an overall good fit.

Table 1: Client culture average absolute residuals

Variable	Un-standardised		Standardised		
	Ave absolute residual	Ave off-diagonal absolute residual	Ave absolute residual	Ave off-diagonal absolute residual	% falling between -0.1 & $+0.1$
leadership	0.0276	0.0355	0.0271	0.0349	94.44%
Commitment	0.0304	0.0380	0.0214	0.0267	97.78%
Involvement	0.0288	0.0384	0.0163	0.0217	100%
Communication	0.0329	0.0411	0.0293	0.0366	97.77%
Competence	0.0076	0.0127	0.0068	0.0113	100%
Procedures	0.0346	0.0445	0.0305	0.0392	94.45%
Overall Client culture	0.0180	0.0200	0.0177	0.0197	100%

3.2 Fit indexes

Despite an indication of a good fit from the residual covariance analysis, evaluation of fit indexes was necessary. A two statistic strategy of fit

indexes is reported in this study. The robust comparative/incremental index, Comparative Fit Index (CFI) and the robust absolute fit index, Root Mean Square Error of Approximation (RMSEA) at 90% confidence interval were evaluated in order to establish fit of the model and are reported in this study. In addition, the Sattora-Bentler scaled chi-square ($S - B\chi^2$) and the Standard Root Mean Squared Residual (SRMR) were evaluated in order to compliment the conclusion on model fit and are also reported. Model analysis was a pure Confirmatory Factor Analysis (CFA) procedure. The findings from measurement models on *leadership*, *involvement*, *procedures*, *commitment*, *communication* and *competence* are presented first and then the full six factor structural model on client culture.

The sample data on the *leadership* factor of client culture and its associated indicator variables, yield a $S - B\chi^2$ of 50.329 with 20 degrees of freedom. The associated p-value was determined to be 0.00020. The ratio of $S - B\chi^2$ to the degree of freedom yield a value of 2.52 which is lower than the acceptable value of 3.0. The robust CFI index was found to be 0.955. A value greater than 0.95 for a well-fitting model is recommended (Hu and Bentler, 1999). The robust RMSEA at 90% confidence interval with the lower bound value of 0.050 and the upper bound value of 0.100 yield 0.075. In addition the SRMR yield an index of 0.041. A good fitting model is expected to have an SRMR index lower or equal to 0.05 whilst an index of 0.08 is sufficient to accept the postulated model. The absolute fit index SRMR accounts for the average discrepancy between the sample and the postulated correlation matrices and therefore it represents the average value across all standardised residuals and ranges from zero to 1.00 in a well fitting model (Byrne, 2006). Evaluation of the above fit indexes indicated an acceptable fit of the measurement model because all the estimates met the cut-off values of > 0.9 for robust CFI, < 0.08 for SRMR (ML), ≤ 0.08 for the robust RMSEA (CI 0.050:0.100). See table 2.

The sample data for the factors *involvement*, *competence* and *commitment* yield index values that suggested a good fit. The CFI index values for those factors were all greater than the 0.95 value and the SRMR indexes were less than the 0.05 recommended values for a good fit model. However, the RMSEA with the 90% confidence, yield values that are merely acceptable as they were greater than 0.05 but crucially less than the 0.08.

As for the client health and safety culture factors of *procedures* and *communication*, the models were less fitting to the sample data. Although the CFI and the SRMR indexes fell within the acceptable range, the RMSEA and the scaled $S - B\chi^2$ indicated a rather weak fit.

The full six factor model was however found to be well fitting to the data. The $S - B\chi^2$ was found to be 219.323 with 137 degrees of freedom (P=0.00001) yielding the chi-square- degree of freedom ratio of 1.60. The CFI was found to be 0.979 whilst the RMSEA with 90% confidence interval (lower bound value = 0.035 and upper bound value = 0.058) was found to be 0.047. The SRMR was found to be 0.025. Those fit indexes for the client H&S culture model was suggestive of a very good fit overall.

Table 2: Robust fit indexes for client culture construct

		$S-B\chi^2$	df	CFI	SRMR	RMSEA	RMSEA CI 90%
Variable	Cut-off index	Acceptable	0.95	0.95	0.08	0.08	
		Good		0.95	0.05	0.05	
	Leadership	50.329	20	0.955	0.041	0.075	0.050:0.100
	Involvement	30.183	14	0.986	0.024	0.064	0.032:0.096
	Procedures	103.998	20	0.934	0.045	0.123	0.100:0.147
	Competence	2.642	2	0.999	0.010	0.034	0:0.129
	Communication	133.395	27	0.940	0.042	0.119	0.099:0.139
	Commitment	64.100	27	0.966	0.031	0.071	0.049:0.093
	Overall Client culture	219.323	137	0.979	0.025	0.047	0.035:0.058

3.3 Significance of parameter estimates

In addition to the overall fitting of the model, the significance of individual parameters is equally important. As such, Raykov (1991) recommend further examination of factor loadings, standard errors and the test statistics in addition to overall fit statistics before conclusions could be made about the appropriateness of the postulated models. Therefore those estimates were examined and are now presented below.

According to Byrne (2006) estimates are said to be unreasonable if they have correlation values that are greater than 1.00, have negative variances and the correlation or covariances are not definite positive. Furthermore, the test statistic has to be greater than 1.96 based on the probability level of 5% before the hypothesis can be rejected (Byrne, 2006). The test statistic reported in this study is the parameter estimate divided by its standard error and therefore it functions as a Z-statistic to test that the estimate is statistically different from zero.

Inspection of the correlation values, standard errors and the test statistic in table 3, show that all correlations were not greater than 1.00, all test statistics were greater than 1.96 and the signs were appropriate. The estimates were therefore reasonable as well as statistically significant. All parameter estimates showed a high correlation values close to 1.00 suggesting a high degree of linear association between the indicator variables and the latent variables. See table 3.

The test statistic, magnitude and signs for the overall six factor client H&S culture also showed that the estimates were reasonable and statistically significant. The covariances among independent variables at 5% level also showed that they were statistically significant. The covariance factor loadings ranged from 0.653 (Involvement (F2) – Leadership (F1)) to 0.942 (Commitment (F4) - Involvement (F2)). Table 4 presents independent variable correlations, standard errors and the test statistic.

Table 3: Coefficients and test statistics of indicator variables (Robust statistical significance at 5% level)

Latent variable	Indicator variable (The client...)	Coefficient	Test statistic	Significant?
Leadership	Considers H&S implications before making decisions on the project	.741	11.011	Yes
	Has an effective H&S policy	.796	13.209	Yes
	Monitors H&S on the project throughout all stages	.816	14.657	Yes
	Monitors designers' H&S implementation	.841	17.700	Yes
	Monitors contractor's H&S implementation	.792	13.641	Yes
	Mandated designers to manage project H&S	.717	11.047	Yes
	Requires that the contractor manages project H&S	.618	8.759	Yes
	Coordinates designers & contractor to ensure good H&S	.798	14.022	Yes
Commitment	Demonstrated positive attitude toward H&S	.839	10.628	Yes
	Actively promoted H&S in a consistent manner across all levels	.806	13.316	Yes
	Provided finance for H&S	.758	11.307	Yes
	Supported implementation of H&S activities	.775	12.254	Yes
	Put in efforts to ensure every aspect of work & operations are routinely evaluated for H&S	.942	17.663	Yes
	Conducted regular H&S tours on the project	.956	17.884	Yes
	Been involved in investigations of accidents, incidents & ill-health on the project	.887	15.811	Yes
	Set H&S as an important agenda item in every project progress meeting	.799	13.116	Yes
Set H&S as a No.1 priority on the project	.957	17.347	Yes	
Involvement	Is personally active in critical project H&S activities	.829	12.956	Yes
	Is always present in project H&S meetings	.919	12.653	Yes
	Contributes to H&S training	.934	17.308	Yes
	Is active in overseeing of H&S on critical operations	.934	18.362	Yes
	Has constantly stayed "in-touch" on H&S issues	.987	19.825	Yes
	Always communicates information on H&S to all parties	.962	18.066	Yes
	Conducts regular audits & inspections	.954	17.972	Yes
Communication	Has set up a formal reporting system of incidents & accidents on the project	.902	16.644	Yes
	Involved all parties in planning for H&S on the project	.865	16.419	Yes
	Involves all parties in H&S review	.820	17.241	Yes
	Has provided timely feedback on reported accidents & incidents on the project	.919	18.530	Yes
	Communicates risk findings to all parties on the project	.977	21.252	Yes
	Clearly made H&S policy statements for the project	.894	17.517	Yes
	Has clearly outlined H&S roles & responsibilities for all parties on the project	.895	18.733	Yes
	Has clearly communicated expected performance on H&S to all	.890	16.611	Yes
Has provided information on H&S risk control to all parties	.965	18.807	Yes	
Competence	Representatives have demonstrated knowledge of H&S	.785	13.082	Yes
	Conducts H&S training for its own staff	.976	20.689	Yes
	Deployed staff on the project that are qualified to manage H&S	.963	18.160	Yes
	Ensured that H&S induction to client staff was done on the project	.997	18.883	Yes
Procedures	Has programs to monitor and analyse H&S implementation	.908	19.753	Yes
	Has clear project H&S goals	.827	15.959	Yes
	Scheduled H&S as a key contract prequalification criteria for all parties	.839	16.215	Yes

	involved in the project			
	Scheduled H&S in all contracts for the parties involved in the project	.770	16.205	Yes
	Conducts regular H&S performance measurement	.945	20.996	Yes
	Has its own H&S committee	.839	13.471	Yes
	Conducts Hazard identification & risk assessment	.963	19.335	Yes
	Required that designers adequately address H&S in their designs	.698	11.397	Yes

Table 4: Covariances among client H&S culture independent variables

Parameter	Test statistic	Significant?
Involvement– Leadership	9.518	Yes
Procedures– Leadership	21.373	Yes
Commitment– Leadership	9.329	Yes
Communication - Leadership	29.969	Yes
Competence - Leadership	17.141	Yes
Procedures - Involvement	12.260	Yes
Commitment - Involvement	69.422	Yes
Communication - Involvement	12.672	Yes
Competence - Involvement	16.363	Yes
Commitment - Procedures	10.518	Yes
Communication - Procedures	27.668	Yes
Competence - Procedures	24.718	Yes
Communication - Commitment	10.285	Yes
Competence - Commitment	15.046	Yes
Competence - Communication	18.018	Yes

Table 5: Client H&S culture factor correlations

Factors	CLL	CLI	CLP	CLT	CLN	CLE
CLL	0					
CLI	0.653	0				
CLP	0.813	0.709	0			
CLT	0.691	0.942	0.682	0		
CLN	0.821	0.749	0.841	0.721	0	
CLE	0.719	0.734	0.819	0.746	0.780	0

The model was also checked against misspecification by examining results from the Lagrange Multiplier Test (LM test). In EQS, a model can be said to be misspecified if there are any misfitting parameters through a LM test (Byrne, 2006). The criterion that was used to evaluate misspecification was to identify any significant drop in the χ^2 values of parameters. Additionally, in the univariate and multivariate analysis, the probability that a parameter estimate was equal to zero should be less than 0.05 in order to be rejected. This is also an indication of misspecification. However, after inspecting

results of the LM test, the results did not reveal any significant misspecification of the model.

3.4 Internal reliability and validity of scores

In order to determine the internal consistency of the composite of the measurement models the Rho coefficient was relied upon more than the Cronbach's alpha coefficient because it provides a good estimate of internal consistency (Byrne, 2006). According to Kline (2005) the reliability coefficient should fall between zero and 1.00. However, values close to 1.00 are desired. The Rho coefficient of internal consistency and the Cronbach's alpha are presented below in table 6. Those values show a high level of internal consistency and thus reliability.

Table 6: Reliability coefficients of internal consistency on client culture scale

Factor	Reliability Coefficients	
	Cronbach's Alpha	Rho reliability coefficient
Leadership	0.918	0.919
Involvement	0.834	0.833
Procedures	0.934	0.935
Commitment	0.867	0.868
Communication	0.958	0.958
Competence	0.923	0.926
Overall client culture	0.963	0.978

4. DISCUSSION AND CONCLUSION

For both the measurement and the full six factor model of client H&S culture, the residual covariance estimates fell within the acceptable range, the robust fit indexes met the cut-off indexes and that all the parameter estimates were statistically significant and feasible. Therefore it can be concluded that the six factor model for client H&S culture namely the LIP+3C, fit the sample data well when analysed with the structural equation modelling in a confirmatory factor analysis. Furthermore, there was no significant evidence that indicated model misspecification and therefore the LM test supported the conclusion that the measurement and full structural model for client H&S culture scale fit well.

However, evidence of high colinearity was observed between the factors of client *commitment* and client *involvement*. The correlation between the two was found to be 0.942. A value that is higher than 0.850 is indicative of high colinearity. High colinearity may mean that respondents could not differentiate between the two concepts and viewed it as one and the same thing.

All indicator variables had strong relationships with the six factors of client H&S culture. The minimum factor coefficient was found to be 0.618 whilst the highest was found to be 0.997. However for the *leadership* factor,

monitoring designers and H&S implementation in a project had a higher bearing than all other indicator variables. The factor coefficients were determined to be 0.841 and 0.816 respectively. On the other hand, client *commitment* was said to be more predicted by whether the client has Set H&S as a No.1 priority on the project (0.957), Conducted regular H&S tours on the project (0.956) and whether they put in effort to ensure that every aspect of work and operations were routinely evaluated for H&S (0.942). As for client *involvement*, staying in touch had the highest factor coefficient at 0.987 indicating that this is the variable that explained or indicated more the aspect of client *involvement*. All the indicator variables for the *involvement* factor loaded very high with factor coefficients of more than 0.90.

Indicator variables for the *communication* factor also had high factor coefficients indicating that they significantly measured the factor. Communicating risk findings to all parties in a project and was found to have the highest factor coefficient of 0.977.

The aspects of training, induction and having an H&S qualified personnel in the establishment, effectively measured the client H&S factor of competence. Further, conducting a hazard identification and risk assessment, monitoring H&S programs and regular H&S performance measurement were considered to effectively measure the H&S procedures factor.

The conclusion on the measurement and structural models of the priori is that the indicator variables measured the factors that they were hypothesised to measure and the overall model fit the data. Therefore, the hypothesis is supported and cannot be rejected that Client health and safety culture can be explained by the factors; leadership, involvement, procedures, commitment, competence and communication.

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The influence of Quantity Surveyors on the Construction Industry's Occupational Health and Safety

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ABSTRACT

Purpose of this paper: The research aimed to ascertain specific roles and responsibilities for Quantity Surveyors concerning health and safety, also the current influence that Quantity Surveyors have on the construction industry's occupational health and safety.

Design/methodology/approach: A qualitative method of data production used non-standardised scheduled pilot interviews of a convenience sample of 3 Quantity Surveyors and two well informed health and safety persons in the Eastern Cape Province. Subsequently a quantitative method of data production using a questionnaire followed in order to obtain data from the target population.

Findings: The empirical study indicates that all the specific health and safety roles and responsibilities have significant gaps between what is regarded as important and how evident the roles are, as perceived by registered Quantity Surveyors.

Research limitations/implications: The current research was limited in that little information on the topic exists and no clear health and safety roles and responsibilities are named for Quantity Surveyors.

Original/value: The results of this paper will assist Quantity Surveyors and tertiary institutions in ascertaining roles and responsibilities that can be applied in construction practice and tertiary offered Quantity Surveying courses in order to aid in increasing the health and safety performance of construction projects.

Keywords: Roles, Responsibilities, Importance, Evidence, Gap

1. INTRODUCTION

The South African construction industry is currently still in fairly good shape after the devastating effects of the global financial crisis. The more positive state of the industry when compared to global counterparts can however be ascribed to the Soccer World Cup 2010 (Smit, 2009: Online). This major event led to a multi-billion infrastructure investment, which boosted the construction industry tremendously the past few years leading up to the event. However, for the industry to make a full recovery, it could take at least 12 -24 months (Smit, 2009: Online). Being put in the global spot-light however, showed that the industry still suffers too many construction injuries and fatalities (Smallwood, Haupt & Shakantu, 2009: 37).

The last couple of years, the levels of health and safety awareness have increased significantly mainly because of the amount of construction injuries and the media coverage that followed (Smallwood, *et al.*, 2009: 30; 38). Studies and investigations by the Department of Labour (DoL) and health and safety inspectorates have shown that the construction industry is guilty of large non-compliance with health and safety legislation in South Africa (South Africa, DoL, 2007: Online). It is therefore necessary to establish methods for reducing non-compliance to lower the high rate of injuries (Smallwood & Haupt, 2005: 2).

All professionals involved in construction projects should play a basic or involved role in the planning and implementing of the health and safety plan for the projects (Croner, 2008: 52).

The Construction Industry Development Board (CIDB) health and safety report states that health and safety must start from the early conception stage through the design phase and into the actual construction phase, to ensure better safety for all individuals involved in the project (Smallwood, *et al.*, 2009: ii).

Previous studies on the impact of the construction regulations has indicated that the Quantity Surveyors are only making marginal impacts on health and safety, but there is great potential for Quantity Surveyors to make a positive impact, primarily by drawing up bills of quantities that incorporate adequate health and safety allowances (Smallwood, *et al.*, 2009: 20).

Smallwood, *et al.* (2009) states that the construction industry is in great non-compliance to the health and safety legislation and this study is intended to determine the current role and the possible role that the Quantity Surveyor can strive to fulfil to help reduce the levels of non-compliance.

The Quantity Surveyor traditionally deals with bills of quantities, contracts, cost control etc. Having sufficient health and safety knowledge, both for planning and implementation can be an area into which this already expanding profession can further expand.

The research reported in this paper aimed to ascertain specific health and safety roles and responsibilities of Quantity Surveyors in order to determine the influence that Quantity Surveyors have on the construction

industry's occupational health and safety. To attain the needed results the following objectives were devised:

- To investigate the perceived importance of health and safety responsibilities for Quantity Surveyors;
- To investigate the perceived levels of the health and safety responsibilities being performed by Quantity Surveyors , and
- To identify the perceived gaps between the above mentioned.

2. REVIEW OF THE LITERATURE

2.1 Back ground and economics related to health and safety

Economics of health and safety refers to cost of accidents and these costs can be categorised into direct or indirect costs (Smallwood & Haupt, 2005: 3). The Health and Safety Executive (HSE) (1993) defines an accident as "any unplanned event that resulted in injury or ill health of people, or damage or loss to property, plant, materials or the environment". Construction work covers a variety of activities, techniques, materials and hazards and it is the diversity that increases the risks and probabilities of accidents occurring (Baxendale & Jones, 2000: 33-40).

Baxendale and Jones (2000) identified construction accidents to be incidents of simple, routine work and in many cases caused by a clear lack of planning.

The direct costs of accidents are the costs related and associated with the treatment of injuries and any unique compensation offered to workers as a consequence of the workers' injuries. These costs will usually be covered by the Workmen's Compensation insurance premiums (Smallwood, *et al.*, 2009: 8). Indirect costs are the costs that are usually carried by the contractor and these costs include reduced productivity, clean up costs, replacements costs, costs resulting from delays, costs related to rescheduling, transportation and wages paid to the injured workers whilst injured (Hinze, 1994: 357-370).

Recent research conducted in the United Kingdom and in South Africa indicated that in the United Kingdom the indirect costs amount to about 11 times the cost of direct costs (Movement for Innovation, 2003: Online). Smallwood (2000) states that in South Africa, the indirect costs were found to amount to 14.2 times the cost of direct costs.

In the United States research found that the cost of accidents constituted 6.5% of the value of the completed construction project and in the United Kingdom approximately 8.5% of the tender price (HSE, 1997: Online). Research in South Africa indicated that the cost of accidents is approximately 5% of the value of the completed construction (Smallwood, *et al.*, 2009: 8).

The main issue with the cost of accidents is that ultimately the Client carries this cost, and that implies that designers should endeavour to contribute to efforts to reduce accidents and provide Clients with a better service (Smallwood & Haupt, 2005: 3). Clients ultimately incur these costs due to the fact the cost of accidents is included in the contractors' cost structures and the cost of accidents to Client will be a substantial amount

with the cost of accidents being around 5% of the value of the construction (Smallwood, *et al.*, 2009: 8).

2.2 Health and safety responsibilities of designers

Croner (2008) describes designers as being those who prepare and modify designs and the description of designs includes drawings, design details, specifications and bills of quantities (Croner, 2008: 56). According to Croner (2008) designers may therefore include the following:

- Architects and Architects Technicians;
- Building Services Engineers;
- Building Surveyors ;
- Quantity Surveyors, and
- Project Managers.

According to Croner (2008/2009) interpretation of the CDM regulations designers have to demonstrate competence by responding to written enquiries from the client or the CDM. Designers will also be required to demonstrate sufficient resources that are available to meet the requirements of the project (Croner, 2008: 56).

Designers influence health and safety either directly or indirectly (Smallwood & Haupt, 2004: Online). Designers can affect health and safety directly through design specific, supervisory and administrative interventions and indirectly through the type of procurement systems used, pre-qualification, project time, partnering and the facilitating of pre-planning (Smallwood, *et al.*, 2009: 19).

Smallwood and Haupt (2004) states that in the South African context designers are required to:

- Provide Clients with all the relevant information about the project that may affect the pricing of the work;
- Inform the principal contractors of any dangers or hazards and provide information for the safe construction of the project;
- Include a geo-science technical report, the design loading of the structure, and the methods and sequence of construction in a report made available to the principal contractor;
- Modify the design or substitute materials where the design makes use of dangerous construction methods and materials that are hazardous to health and safety ;
- Consider health and safety In the maintenance of the building after completion;
- Conduct inspections to ensure that the construction conforms to the design, and
- Stop construction work not conforming to the design.

The CDM states that designers must advise Clients of their duties that the construction regulations place upon them (Croner, 2008: 56-57). The designers have to consider health and safety in their designs during the construction, future maintenance and the final demolition of the structure and they are further required to (Croner, 2008: 57):

- Identify Hazards that will occur during construction and maintenance;
- Eliminate risks where possible;
- Reduce risks, and
- Provide adequate information on the risks that could not be eliminated.

2.3 Health and safety responsibilities of the Quantity Surveyor

Traditionally Quantity Surveyors duties will include preparing feasibility studies and budgets for proposed projects, to prepare bills of quantities and other tender documentation, negotiating and drafting building contracts and documentation, monitoring costs and reporting to the Client during the design and construction phases of a project and lastly to draw up final accounts for projects (ASAQS, nd: Online). The duties of modern Quantity Surveyors have expanded and Smallwood *et al.* (2009) states that Quantity Surveyors can have a direct influence on construction health and safety.

Smallwood *et al.* (2009) identified the need for Quantity Surveyors to draw up specifications that ensure that principal contractors have made adequate allowances for health and safety and these specifications can be included in the bills of quantities drawn up for tendering. This will ensure that tenderers comply with the regulations (Smallwood, *et al.*, 2009: 20).

Smallwood *et al.* (2009) also indicated more relating roles to the Quantity Surveyors duties, these includes the pre-qualification or selection of contractors based on health and safety and quality, also mentioning specific health and safety allowances for health and safety in the contract documentation (Smallwood, *et al.*, 2009: 20). Smallwood (2008) also notes that health and safety can be influenced by designers but more specifically the Quantity Surveyors by the pre-qualification of contractors (Smallwood, 2008: Online)

These statements can be backed by the requirements within the construction regulations that state that the Client is responsible for ensuring that potential contractors who have submitted tenders, have made provision for the cost of health and safety measures in the submitted tenders (South Africa, DoL, 2003: Online). Relating the previous statement to the roles and duties of the Quantity Surveyor it becomes clear that the Quantity Surveyor performing a service to the client should undertake these duties as part of the due diligence towards the client (ASAQS, n.d: Online).

The Royal Institute of Chartered Surveyors (RICS) lays out levels of health and safety competency for Quantity Surveyors who want to be competent in health and safety according to the likely knowledge, skills and experience at each level (RICS, 2006: Online).

Level 1 includes being able to demonstrate knowledge and understanding of the principals and responsibilities imposed by law, codes of practise and other regulations appropriate to the area of practise (RICS, 2006: Online). Examples of knowledge compromised within this level are person safety on and off site, procedures imposed by law and the impact on health and safety of (RICS, 2006: Online):

- Design;
- Construction process;
- Building maintenance, and
- Employment of staff.

Level 2 includes being able to apply evidence of practical application of health and safety issues and the requirements for compliance in the specific area of practise (RICS, 2006: Online). Examples of activities and knowledge comprised in this level are obtaining a formal health and safety qualification that includes First Aid either industry specific or nationally recognised qualifications (RICS,2006: Online).

Level 3 includes being able to provide evidence of reasoned advice given to Clients and others on all aspects of health and safety (RICS, 2006: Online). This level's health and safety examples of knowledge and activities include giving reasoned advice on and/or taking responsibility for health and safety issues relating to (RICS, 2006: Online):

- Impact of design on construction;
- Alternative construction processes;
- Impact of design on occupation and maintenance;
- Undertaking risk assessments, and
- Current legislation.

2.4 Evidence of health and safety responsibilities being carried out by Quantity Surveyors

A Study on the impact of the construction regulation revealed that currently Quantity Surveyors don't have a great influence on health and safety (Smallwood, *et al.*, 2009: 20). Smallwood and Haupt (2006) conducted research that indicated that Quantity Surveyors in 2006 were not influencing health and safety sufficiently. This problem was again uncovered by Smallwood *et al.* (2009) that states that Quantity Surveyors aren't influencing health and safety notably, and more specifically to the extent to which Quantity Surveyors can in fact influence the health and safety of the Construction industry (Smallwood, *et al.*, 2009: 20).

The data above that identifies the responsibilities of the Quantity Surveyor research conducted by Smallwood and Haupt (2006), concerning the manifestation of the impact of the construction regulations on health and safety, revealed that Quantity Surveyors ranked the influence of pre-qualification last and also ranked changes in work places low. Quantity Surveyors also ranked the procurement of practises and the review of forms of contract fairly low. The review of provision for health and safety was ranked in the top six and Quantity Surveyors ranked the increase of awareness for health and safety in the top three (Smallwood & Haupt, 2006: Online)

3. RESEARCH

3.1 Methodology

A qualitative method of data production used non-standardised scheduled pilot interviews of a convenience sample of 3 Quantity Surveyors and two well informed health and safety persons in the Eastern Cape Province.

Subsequently a quantitative method of data production using a questionnaire followed in order to obtain data from the target population.

3.2 Questionnaire design

The questionnaire was the primary data collecting tool and was created, formatted and tested in an Excel® (Microsoft Ltd) worksheet. Once the questionnaire was finalised it was re-created using the Nelson Mandela Metropolitan University (NMMU) Web Survey. The NMMU Web Survey allows for easy completion of the questionnaire by using an online based web site. After careful inspection and completion of the questionnaire it was administered to the sample. Respondents were requested to follow the link to the NMMU Web Survey site which allowed the respondents to complete the questionnaire using the internet. The design allowed the respondents to easily complete the questionnaire through indicating their preference by clicking on radio buttons.

The questionnaire consisted of four sections. Section one consisted of demographic questions, which were later used to test if any of the variables had a significant influence on the rating of the responsibilities.

In section two, Quantity Surveying related general health and safety responsibilities were listed with two scales next to it (these results will not be discussed).

In section three the Quantity Surveying specific health and safety responsibilities that were identified through the literature and preliminary qualitative study were listed with two scales next to it. The two scales were:

- The perceived level of importance of each health and safety responsibility for Quantity Surveyors, rated from “Not important” (rating 1) to “Very important” (rating 5). An “Unsure” option was also included.
- How evident each health and safety responsibilities is in the Quantity Surveying professional currently, from “Not evident” (rating 1) to “Very evident” (rating 5). An “Unsure” option was also included.

Section four consisted of three open-ended questions on health and safety responsibilities for Quantity Surveyors, including health and safety in tertiary Quantity Surveying courses and the perception of Quantity Surveying involvement in health and safety. (the results will not be discussed in detail).

3.3 Sample size

A membership list of registered Quantity Surveyors was obtained from the Association of South African Quantity Surveyors (ASAQS) which identified 1952 members. After which Krejcie and Morgan’s (1970) equation was used to calculate a target sample size of 321. Simple random sampling was used in order to select the sample from the population.

3.4 Response rate

Sixty-four (64) questionnaires were completed three weeks after the first e-mail was sent, during which two reminder e-mails were sent to the sample. Therefore, a response rate of 20.00% was achieved.

Sheehan (2001) in a review of e-mail surveys found an average response rate of 31% during 13 studies in 1998/9. The response rate achieved in this study can be considered to be low compared Sheehans' (2001) findings. However compared to recent studies within the construction industry by Crafford (2002) = 19.3% and Nkado (1999) = 25.0%, the response rate can be considered acceptable.

3.5 Most important specific health and safety responsibilities for Quantity Surveyors

The most important specific health and safety responsibilities as identified by Quantity Surveying professionals are (As per Table 1) (1) planning for health and safety cost allowances; (2) evaluating the cost implications of health and safety risks in design; (3) consider health and safety through every phase of a project; (4) being able to set up itemized allowances in the bills of quantities sections for health and safety; and (5) ensuring that contractors have workers compensation insurance cover in their tenders. The majority of the responsibilities above relate to planning for health and safety costs, these findings concur with Smallwood, *et al.* (2009) stating that there is a need for Quantity Surveyors to draw up adequate allowances for health and safety on construction projects. Smallwood *et al.* (2009) also states that it is important for Quantity Surveyors to be able to draw up specific health and safety allowances in the bills of quantities.

The specific health and safety responsibilities which Quantity Surveying professionals consider to be most evident are (As per Table 1) (1) having the ability to plan for health and safety cost allowances; (2) having the ability to set up itemized allowances in the bills of quantities sections for health and safety; (3) having the ability to set up separately identifiable health and safety section in bills of quantities; (4) having the ability to evaluate the cost implications of health and safety risks in design; and (5) ensuring that contractors have workers' compensation insurance in their tenders.

Table 1 Importance and evidence of specific health and safety responsibilities for Quantity Surveyors

<i>Specific health and safety responsibilities</i>	<i>Importance %</i>	<i>Evidence %</i>	<i>Rank: Importance, evidence</i>
Planning for health and safety cost allowances	81%	65%	1,1
Evaluating the cost implications of health and safety risks in design	80%	60%	2,4
Considering health and safety through every phase of a project	71%	47%	3,12
Setting up itemized allowances in the Bills of Quantities sections for health and safety	71%	64%	4,2
Ensuring that contractors have workers' compensation insurance cover in their tenders	71%	59%	5,5

Suggesting to clients that contractors be pre-qualified on a health and safety competency basis	71%	50%	6,10
Ensuring that contractors have adequate health and safety allowances in their tenders	70%	54%	7,7
Aiding in solutions to design health and safety risks from a value management perspective	68%	54%	8,6
Reporting back to clients on the health and safety competency of a contractor's tender from a cost planning perspective	68%	53%	9,8
Setting up a separately identifiable health and safety section in the bills of quantities	68%	62%	10,3
Identifying health and safety risks in designs	65%	50%	11,11
Commenting on the design's health and safety risks	65%	51%	12,9
Evaluating tenders on the basis of the contractors' health and safety competency	60%	46%	13,13

3.6 Quadrant Analysis

An Importance-Evidence quadrant analysis (Figure 1) was done in order to integrate the ratings of the current importance levels and current proficiency levels. This helped to identify areas in which education and training is immediately needed.

The average rating for the importance and evidence scale is 66% ($3.3/5 \times 100$). It can therefore be seen that the majority (10 out of 13) of the specific health and safety responsibilities were rated as "Above average" in terms of importance and all of the specific health and safety responsibilities were rated as "Below average" in terms of evidence by quantity surveying professionals.

Therefore the majority (8 out of 13) of the specific health and safety responsibilities need immediate attention except for the following soft skills which need to be de-emphasized:

- Being able to report back to clients on the health and safety competency of a contractor's tender from a cost planning perspective;
- Being able to set up a separately identifiable health and safety section in the bills of quantities;
- Being able to identify health and safety risks in designs;
- Being able to comment on the design's health and safety risks, and
- Evaluating tenders on the basis of the contractors' health and safety competency.

Alarming areas related to the quadrant analysis were being able to set up separately identifiable health and safety section in the bills of quantities that was placed in the de-emphasise block, which is inconsistent with Smallwood *et al.* (2009) suggesting that this is an important area for Quantity Surveyors to focus on. Another responsibility that was placed in the de-emphasise block was evaluating tenders on the basis of contractors' health and safety competency which again was inconsistent with Smallwood *et al.* (2009).

Level of evidence	Above Average	Maintain or de-emphasise	Continuous improvement
	Below Average	De-emphasise	Immediate attention
		Below Average	Above Average
		Importance rating	

Figure 1 Importance-Evidence quadrant analysis

3.7 Gap Analysis

If it is assumed that a significant gap is represented by a 20% difference in ratings the following specific health and safety responsibilities have significant gaps between current importance and evidence ratings (Table 2): (1) considering health and safety through every phase of a project; (2) suggesting to clients that contractors be pre-qualified on a health and safety competency basis, and (3) being able to evaluate the cost implications of health and safety risks in design.

Three of the top five responsibilities ranked according to importance, also appear in the top five responsibilities with the largest gaps. Considering health and safety through every phase of a project ranked third according to importance, however it has an importance-evidence gap of 24% placing it at the top of the table. Being able to evaluate the cost implications of health and safety risks in design ranked second in terms of importance, but when considering the importance-evidence gap it ranked third with 20%.

Table 2 Gap analysis of specific health and safety responsibilities for Quantity Surveyors

<i>Specific health and safety responsibilities</i>	<i>Gap %</i>	<i>Rank</i>
Considering health and safety through every phase of a project	24%	1
Suggesting to clients that contractors be pre-qualified on a health and safety competency basis	21%	2
Being able to evaluate the cost implications of health and safety risks in design	20%	3
Ensuring that contractors have adequate health and safety allowances in their tenders	16%	4
Being able to plan for health and safety cost allowances	16%	4
Being able to identify health and safety risks in designs	15%	6
Being able to report back to clients on the health and safety competency of a contractor's tender from a cost planning perspective	15%	6
Evaluating tenders on the bases of the contractors' health and safety competency	14%	8
Being able to aid in the solutions to design health and safety risks from a value management perspective	14%	8
Being able to comment on the design's health and safety risks	14%	8
Ensuring that contractors have workers' compensation insurance cover in their tenders	12%	11
Being able to set up itemized allowances in the Bills of Quantities sections for health and safety	7%	12
Being able to set up a separately identifiable health and safety section in the bills of quantities	6%	13

These findings indicate that Quantity Surveying professionals are not currently performing the health and safety responsibilities, as ranked important by them, proficiently.

4. CONCLUSIONS

In terms of the objectives the following conclusions can be drawn from the empirical study:

- The majority (10 out of 13) of the suggested responsibilities were ranked as important by Quantity Surveying professionals;
- Quantity Surveying professionals recognise the importance of health and safety responsibilities, however they indicated that these responsibilities are not being proficiently carried out, and
- There appears to be considerable gaps between what specific health and safety responsibilities are regarded as important and the evidence of these responsibilities being proficiently carried out. .

The literature however suggests that there are certain specific health and safety responsibilities that are important for Quantity Surveyors to take on. The findings however disprove certain of these suggestions and this could prove to be the stumbling block for Quantity Surveying involvement in health and safety.

5. RECOMMENDATIONS

For health and safety to be successfully managed from a Quantity Surveying perspective, attention needs to be given to increasing the knowledge and motivation of Quantity Surveyors towards health and safety. The possible introduction of training courses that introduce Quantity Surveyors to health and safety, could aid narrowing down the gaps that were uncovered. These courses could possibly focus on providing Quantity Surveyors with basic health and safety knowledge and also means of implementing health and safety responsibilities successfully.

Professionals and tertiary institutions can gain knowledge from the findings about the health and safety responsibilities of Quantity Surveyors and build on their knowledge and do further research to increase the professions understanding of its responsibilities towards construction health and safety and the effective management thereof.

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Practitioners' perceptions of competencies possessed by Quantity Surveying graduates

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ABSTRACT

Purpose of this paper: The research aimed to ascertain practitioners' perceptions about the extent of graduates' competencies.

Design/methodology/approach: A qualitative method of data production used non-standardised scheduled pilot interviews of a convenience sample of 10 quantity surveyors in the Eastern Cape Province. Subsequently a quantitative method of data production using a questionnaire followed in order to obtain data from the target population

Findings: The empirical study indicates that all the competencies have significant gaps between what is regarded as important and how evident that competency is, as perceived by registered quantity surveyors.

Research limitations/implications: The current research was limited in that it only included competencies as identified by the South African Council for the Quantity Surveying Profession (SACQSP). Future research can include competencies identified by the Royal Institution of Chartered Surveyors (RICS).

Original/value: The results of this paper will assist students, graduates and tertiary institutions in understanding the value that employers put on competencies and thereby establishing the most important competencies as well as the most evident competencies.

Keywords: Competencies, Importance, Evidence, Gap

1. INTRODUCTION

The South African Council for the Quantity Surveying Profession (SACQSP) indicates that a candidate quantity surveyor needs to demonstrate their competence in Cost advice and cost planning; Contract documentation; Tendering and contractual arrangement; Contract services and Specializations in order to be successful in the Assessment of Professional Competence (APC) (South Africa, 2009).

Seeley (1997) states that the quantity surveyor is essentially a cost expert whose prime task is to ensure that a construction project is kept within the agreed budget and that the employer obtains value for money. Leveson (1996) also suggests that quantity surveying competencies lie in the financial and contractual control and tasks of projects.

Davis and Muir (2004) define technical skills as the technical knowledge and abilities required to perform specific job-related tasks. Hamel and Prahalad (1990) suggest that core competence refers to an integrated set of core technologies and core skills that provide an organisation with its competitive advantage. Boyatzis (1982) defines competencies broadly as an underlying characteristic of a person such as a motive, trait, skill, aspect of a person's self-image or social role, or a body of knowledge, which the individual uses and possesses.

The Royal Institution of Chartered Surveyors (RICS, 2006) suggests that competencies are a mix of technical and professional practice, interpersonal, business and management skills that are considered common to, and necessary for, all chartered and technical surveyors. An individual's ability to effectively deploy the above mentioned competencies in the workplace benefits not only the individual but also the company (Halfhill & Nielson, 2007). Therefore, in an effort to change perceptions, it is important to quantify the value of competencies by directly linking them to the relevant curriculum outcomes.

The research reported in this paper aimed to ascertain practitioners' perceptions about the extent of quantity surveying graduates' competencies. To attain the needed results the following objectives were devised:

- To investigate the perceived importance of competencies possessed by quantity surveying graduates;
- To investigate the perceived levels of the competencies possessed by quantity surveying graduates, and
- To identify the perceived gaps between the above mentioned.

2. REVIEW OF THE LITERATURE

2.1 Competency Definitions

Individuals pursue education to obtain the technical knowledge (technical skills) necessary for practicing in a desired profession as a professional consultant. Dubois (1993), defines competence as the employee's capacity to meet, or exceed a job's requirements by producing the job outputs at an expected level of quality within the constraints of the organization's internal and external environments.

Holmes and Joyce (1993) defines competence as an action, behaviour or outcome which a person should be able to demonstrate, or the ability to transfer skills and knowledge to new situations within an occupational area. Meyer and Semark (1996) add two new dimensions into this definition i.e. personal attributes and value orientation. Roggema-van Heusden (2004) define competence from a professional personnel point of view as “the ability to perform well in a professional situation that involves the accomplishment of a certain task or the dealing with a problem, in a manner that can be observed and be judged by others”. A competent professional is capable of applying the necessary expertise in confluence with effective behaviour.

To be competent is to have the skill or ability to perform a task or function (RICS: 2006). Crafford (2007) suggests that a competency is a dimension of overt, manifest behaviour that allows a person to perform competently and behind it must be both the ability and desire to behave in that competent way. For example, the person competent at selling will need a competency that includes listening. In turn, that includes knowing how to listen and choosing to listen (Crafford & Slabber, 2009).

“Competence and competency, though variously defined, can be considered as synonymous” (Nkado & Meyer, 2001). Even though competency definitions differ through the years they are synonymous. Being competent means being able to carry out expected technical tasks effectively, accurately and efficiently.

2.2 Competencies and the Councils

It is essential that a profession is governed by a professional body to maintain the competence and control the standards of conduct of the profession (Bennion, 1969). The title of chartered member is taken as recognition of professional competence. The competence of professionally qualified quantity surveyors is well established and regulated by professional bodies like the SACQSP and the RICS. The title of chartered quantity surveyor is only awarded to those professionals who have passed the professional competence test set by these institutions. Clients therefore have some assurance of the standard of the intangible service they are purchasing under this system (Fong and Choi, 2009).

According to Ashworth and Hogg (2001), the SACQSP (2000: online) state that there are five areas of approved experience and skills to be gained for Assessment of Professional Competence (APC) qualification. If a trainee's experience is too narrow they may be requested to resubmit the log books after broader experiences have been achieved. These five areas according to Ashworth and Hogg (2001) and SACQSP (2000: online) are:

- Contract documentation;
- Cost advice and cost planning;
- Tendering and contractual documentation;
- Contract services, and
- Specialisations.

These skill groups are then divided into the various competencies which form each group (SACQSP, 2000: online).

2.3 Competence and its Relevance in the Quantity Surveying Profession

A quantity surveyor is a professional in the construction industry who has the ability to analyse both cost components and practical physical construction works of a project in a successful way, so as to be able to apply the results of an analysis in solving problems peculiar to each project (Badu and Amoah, 2004). Quantity surveyors are also construction economists who fulfil varied and comprehensive duties to support cost-effective construction and property development projects (Said, Shafiel & Omran, 2010).

Traditionally, quantity surveyors have fulfilled the function of financial and contractual controller of projects and therefore proficiency in the related competencies is important. However, in recent years the quantity surveying profession has endeavoured to broaden the role of quantity surveyors to include inter alia, project management and facilities management (Crafford and Smallwood, 2007). Brümmer (2004) shows that trends in the industry are continuously changing and innovative procurement systems are part of the reality of future services that the quantity surveyor can provide.

Grant (2004) suggests that related specialized fields may hold the key to future sustainability and that future strategies for quantity surveying and project management services should include provision for strengthening of strategic assets such as education, training and experience to ensure that the role of the professions remains viable, effective and dynamic;

Verster (2004) reiterates that professionals should have an understanding of these developments and should proactively participate in developing competencies to be able to adapt to future service requirements and hence the needs within the industry. With no real sign of the current economic downturn easing for some time to come, it is becoming even more necessary to establish which competencies are important to the quantity surveying profession for current and future success and therefore which competencies need attention (Crafford & Slabber, 2009).

From being a trade-based vocation, quantity surveying has developed into a full-fledged profession widely accepted in the construction industry today. The quantity surveyors, in its present day construction industry, have the ability to analyse cost components of a construction project in a scientific way and apply the results of this analysis to a variety of financial and economic problems confronting the developer and the designer. Badu and Amoah (2004) held that these changing roles had been redefined by the educational system received by the quantity surveyors.

3. RESEARCH

3.1 Methodology

A preliminary research approach comprising of a qualitative method of data collection used non-standardised scheduled pilot interviews of a convenient sample of quantity surveyors in the Eastern Cape Province. A total of 10 quantity surveyors were interviewed. The interviews tested the quantity surveyors understanding of the defined competencies with the possibility of adding additional competencies. A questionnaire was developed taking into consideration the data collected during the pilot interviews. Subsequently, the questionnaire was administrated to the target sample.

3.2 Questionnaire design

The questionnaire was formatted and tested in an Microsoft Excel worksheet. Once the questionnaire was finalised it was administered using the Nelson Mandela Metropolitan University (NMMU) Web Survey which allowed the respondents to complete the questionnaire using the internet. The design allowed the respondents to easily complete the questionnaire through indicating their preference by clicking on radio buttons.

The questionnaire consisted of four sections. Section one consisted of demographic questions, which were later used to test if any of the variables had a significant influence on the rating of the competencies.

In section two, quantity surveying competencies according to the SACQSP were listed with two scales next to it. The two scales were:

- The perceived level of importance of each competency for a graduate quantity surveyor, from “Competency is redundant, not at all required from a quantity surveying graduate” (rating 1), to “It is imperative for a quantity surveying graduate to possess this competency and understand it and can carry it out to all degrees” (rating 7). An “Unsure” option was also included.
- How evident each competency is in quantity surveying graduates currently, from “Absolute no recognition of competency” (rating 1) to “Competency fully mastered to all degrees” (rating 7). An “Unsure” option was also included.

In section three the quantity surveying soft skills that were identified through the literature and preliminary qualitative study were listed with two scales next to it (the results of this section are not discussed in this paper).

Section four consisted of three open-ended questions on competencies and soft skills possessed by graduate quantity surveyors (Not discussed in this paper).

3.3 Sample size

A membership list of registered quantity surveyors was obtained from the Association of South African Quantity Surveyors (ASAQS) which identified 1952 members. After which Krejcie and Morgan’s (1970) equation was used to calculate a target sample size of 321. Simple random sampling was used in order to select the sample from the population.

3.4 Response rate

Seventy questionnaires were completed four weeks after the first e-mail was sent, during which two reminder e-mails were sent to the sample. Therefore, a response rate of 21.81% was achieved.

This is a smaller response rate than normally achieved with an e-mail questionnaire survey. Sheehan (2001) in a review of e-mail surveys found an average response rate of 31% during 13 studies in 1998/9.

It can therefore be seen that the response rate was slightly lower than can be expected from an e-mail survey, even though the following techniques were used to increase the response rate:

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- The Internet survey interface was designed to appeal to respondents in terms of ease of use and referencing;
- The respondents were assured of anonymity;
- All the e-mails were personalised by using the name and surname on the e-mails;
- Each respondent was promised an executive summary of the research results;
- The first reminder e-mail was sent two weeks after the initial mailing, and
- The second e-mail reminder was sent one week after the first reminder.

3.5 Relative importance of competencies for quantity surveying graduates

The most important competencies as identified by quantity surveying professionals are (1) Preparing bills of quantities for principal contracts; (2) Calculating of CPAP; (3) Preparing cost benefit reports on alternative construction methods; (4) Preparing and finalizing final accounts; and (5) Statutory requirements, knowledge of SACQSP. The majority of the competencies above relate to contractual competencies which Leveson (1996) indicates as essential competencies for quantity surveyors to possess.

The competencies which quantity surveying graduates' are realising the best are (1) Attending site meetings; (2) Preparing bills of quantities for principal contracts; (3) Surveying, measuring and recording work for final account purposes; (4) Preparing valuations for interim certificates; and (5) Preparing and finalizing final accounts.

Table 1 Importance and evidence of quantity surveying graduate competencies

Graduate Competencies	Importance	Evidence
Preparing bills of quantities for principal contracts	89.0%	67.0%
Calculating of CPAP	87.0%	60.0%
Preparing cost benefit reports on alternative construction methods	86.0%	48.0%
Preparing and finalizing final accounts	85.0%	63.0%
Statutory requirements, knowledge of SACQSP	84.0%	57.0%
Preparing schedules of rates	83.0%	59.0%
Preparing and using cost data	83.0%	59.0%
Estimating final costs and reporting on the financial aspects	82.0%	58.0%
Cost control during progress of the works	82.0%	60.0%
Preparing and agreeing final accounts	82.0%	62.0%
Reporting on, evaluating and negotiating contractual and extra-contractual issues	82.0%	54.0%
Knowledge of JBCC	81.0%	58.0%
Preparing estimates	80.0%	61.0%
Advising on method of tendering	79.0%	52.0%
Preparing cost/value reconciliation statements	79.0%	57.0%
Knowledge of less popular contracts (Fidic, NEC, GCC, etc)	78.0%	42.0%
Preparing specifications	78.0%	48.0%
Attending site meetings	78.0%	69.0%

Life cycle costing	78.0%	48.0%
Formulating/implementing procedures on tendering and contractual arrangements for principal contracts	76.0%	54.0%
Preparing and using detailed budgets and cost plans	76.0%	55.0%
Recommendation of proposed construction methods or sequences	75.0%	48.0%
Preparing tenders including compilation of rates for work and preliminaries	74.0%	54.0%
Undertaking financial feasibility and comparative investment studies	74.0%	55.0%
Contract correspondence	73.0%	57.0%
Preparing bills of quantities for Nominal sub-contracts	73.0%	62.0%
Preparation of fee accounts based on the Tariff of Fees	73.0%	57.0%
Formulating/implementing procedures on tendering and contractual arrangements for Nominated sub-contracts	73.0%	53.0%
Cost control and reporting during pre-contract period	72.0%	56.0%
Scrutinising priced B.o.Q with regards to rates	72.0%	60.0%
Codes of conduct and professional ethics	72.0%	59.0%
Advising on selection of tenders: Evaluation of and reporting on tenders	72.0%	55.0%
Preparing and interpreting cash flow projections and profit/loss forecasts	70.0%	53.0%
Compiling and using cost limits	69.0%	49.0%
Drafting of preliminaries, preambles and contract conditions	69.0%	52.0%
Cost checking during design development	67.0%	52.0%
Preparing valuations for interim certificates	65.0%	66.0%
Surveying, measuring and recording work for final account purposes	65.0%	67.0%
Preparing and applying cost-in-use studies	63.0%	50.0%
Contractual correspondence	61.0%	57.0%

3.6 Quadrant Analysis

Quadrant analysis is a variation of the cross-tabulation table. Quadrant analysis plots two rating scale questions into four quadrants on a two-dimensional table (Zikmund, 1994).

An Importance-Evidence quadrant analysis was done in order to integrate the ratings of the current importance levels and current proficiency levels. This will help to identify areas in which education and training is immediately needed.

The average rating for the importance and evidence scale is 51% (3.6/7*100). It can therefore be seen that all the competencies were rated as "Above Average" in terms of importance and 33 of the 40 competencies are rated as "Above Average", in terms of evidence by quantity surveying professionals.

Therefore all the competencies need continuous improvement except for the following competencies which need immediate attention:

- Preparing cost benefit reports on alternative construction methods;
- Knowledge of less popular contracts (Fidic, NEC, GCC, etc);
- Preparing specifications;
- Life cycle costing;
- Recommendation of proposed construction methods or sequences;
- Compiling and using cost limits, and
- Preparing and applying cost-in-use studies.

Level of evidence	Above Average	Maintain or de-emphasise	Continuous improvement
	Below Average	De-emphasise	Immediate attention
		Below Average	Above Average
		Importance rating	

Table 2 Gap analysis of quantity surveying graduates' competencies

Graduate Competencies	GAP	Gap rating
Preparing cost benefit reports on alternative construction methods	38.0%	1
Knowledge of less popular contracts (Fidic, NEC, GCC, etc)	36.0%	2
Preparing specifications	30.0%	3
Life cycle costing	30.0%	4
Reporting on, evaluating and negotiating contractual and extra-contractual issues	28.0%	5
Calculating of CPAP	27.0%	6
Statutory requirements, knowledge of SACQSP	27.0%	7
Advising on method of tendering	27.0%	8
Recommendation of proposed construction methods or sequences	27.0%	9
Preparing schedules of rates	24.0%	10
Preparing and using cost data	24.0%	11
Estimating final costs and reporting on the financial aspects	24.0%	12
Knowledge of JBCC	23.0%	13
Preparing bills of quantities for principal contracts	22.0%	14
Preparing and finalizing final accounts	22.0%	15
Cost control during progress of the works	22.0%	16
Preparing cost/value reconciliation statements	22.0%	17
Formulating/implementing procedures on tendering and contractual arrangements for principal contracts	22.0%	18
Preparing and using detailed budgets and cost plans	21.0%	19
Preparing and agreeing final accounts	20.0%	20
Preparing tenders including compilation of rates for work and preliminaries	20.0%	21
Formulating/implementing procedures on tendering and contractual arrangements for Nominated sub-contracts	20.0%	22
Compiling and using cost limits	20.0%	23
Preparing estimates	19.0%	24
Undertaking financial feasibility and comparative investment studies	19.0%	25
Advising on selection of tenders: Evaluation of and reporting on tenders	17.0%	26
Preparing and interpreting cash flow projections and profit/loss forecasts	17.0%	27
Drafting of preliminaries, preambles and contract conditions	17.0%	28
Contract correspondence	16.0%	29
Preparation of fee accounts based on the Tariff of Fees	16.0%	30
Cost control and reporting during pre-contract period	16.0%	31
Cost checking during design development	15.0%	32
Codes of conduct and professional ethics	13.0%	33
Preparing and applying cost-in-use studies	13.0%	34
Scrutinising priced B.o.Q with regards to rates	12.0%	35
Preparing bills of quantities for Nominal sub-contracts	11.0%	36
Attending site meetings	9.0%	37
Contractual correspondence	4.0%	38
Preparing valuations for interim certificates	-1.0%	39
Surveying, measuring and recording work for final account purposes	-2.0%	40

It is assumed that a significant gap is represented by a 20% difference in ratings. The ten competencies which have the most significant gaps

ranging from 24% - 38% between current importance and evidence ratings are: (1) Preparing cost benefit reports on alternative construction methods; (2) Knowledge of less popular contracts (Fidic, NEC, GCC, etc); (3) Preparing specifications; (4) Life cycle costing; (5) Reporting on, evaluating and negotiating contractual and extra-contractual issues; (6) Calculating of CPAP; (7) Statutory requirements, knowledge of SACQSP; (8) Advising on method of tendering; (9) Recommendation of proposed construction methods or sequences and (10) Preparing schedules of rates.

Preparing cost benefit reports on alternative construction methods is ranked as the third most important competency but a gap of thirty-eight percent (38%) is evident. It is quite alarming that the top twenty most important competencies have a gap exceeding twenty percent (20%) which indicates that there is a large gap which exists between importance and evidence of competencies with regard to quantity surveying graduates.

Preparing valuations for interim certificates and surveying, measuring and recording work for final account purposes are the only two competencies where the evidence exceeds the importance. It is alarming however that the measuring competency has such a low importance rating.

4. CONCLUSIONS

In terms of the objectives the following conclusions can be drawn from the empirical study:

- All the competencies listed are considered to be imperative for a graduate quantity surveyor;
- Registered quantity surveyors are of the opinion that graduate quantity surveyors possess a little of the competencies and knows what it entails.
- There appears to be considerable gaps between what is expected of a graduate quantity surveyor, and what skill level a graduate is perceived to have, by the registered quantity surveyors.

The research added to the current Quantity Surveying competency body of knowledge by adding various competencies to the existing set of competencies identified by the SACQSP and highlighting the areas in which tertiary institutions need to focus on.

5. RECOMMENDATIONS

Simulation work experience provided by some colleges cannot replace the wealth of experience gained in a surveyors' office or on site with a contractor, therefore it is widely accepted that the only effective training, is while being on the job (Ashworth & Hogg, 2001).

Tertiary institutions should provide a basic foundation of teaching these various competencies to graduates by making graduates familiar with what the various competencies required from candidate quantity surveyors are. Furthermore tertiary institutions should help graduates fulfill required skill sets with regard to the various competencies required.

Employers should provide training, teach employees to be good service providers, and recognize and reward improvement in these

competencies in fulfillment of the APC qualification in both the performance appraisal and compensation programs. While candidate quantity surveyors are working, employers must ensure the competencies are being fulfilled within a reasonable time period.

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Impact of prefabrication on construction site health and safety: Perceptions of designers and contractors

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Abstract

Purpose: While construction processes on site involve raw material and labour, they also expose workers to various health and safety challenges. This paper reports findings of the potential impact of prefabrication and pre-assembly on health and safety in construction.

Design/methodology/approach: The methodology includes a review of relevant literature on health and safety in construction focusing on the jobsite activities of construction workers and the benefits of prefabrication and pre-assembly. A series of research survey instruments were developed which included both open- and closed-ended questions. These were targeted at designers and contractors in the Western Cape Province. Purposive sampling techniques were used.

Findings: The study confirmed that the use of prefabrication and pre-assembly would lead to improvements in construction health and safety performance. The study also confirmed that traditional labour-intensive construction methods exposed workers to more hazards when compared to prefabrication and pre-assembly. The use of prefabrication and pre-assembly were found to potentially reduce exposure to physical demanding activities and ergonomic hazards on site. Further, reduction of manual material handling would lead to overall improvement of the wellbeing of workers.

Research limitations/implications: This particular paper focuses on perceptions of contractors given that they remain responsible for

construction work on site and designers due to their responsibility for specifying construction materials.

Practical implications: The study increases the awareness of the benefits of prefabrication in South African construction with particular reference to overall improvement of health and safety.

Originality/value: This study forms part of M-tech degree which was undertaken in the Western Cape and the findings provide advantages to reduce health and safety threats on site.

Keywords: health and safety, material handling, prefabrication, ergonomic hazards

1. Introduction

The construction industry adopts various methods to bring about the required structure. Typically, in every construction project, health and safety of workers will remain a major concern on site due to accidents, fatalities and illnesses which occur regularly. While the working conditions within the construction industry have resulted in large numbers of accidents, illnesses and fatalities among construction workers (U.S. Department of Labour, 2001), in South Africa general workers were still employed off the streets with no health and safety experience, contributing to the increased likelihood of accidents and injuries (Engineering News, 2006). As a result, there is recognition that the construction industry is one where safety and health related risks remain unacceptably high in developing countries like South Africa and in need of minimization (Eppenberger, 2007).

Although, several research studies have been conducted to examine the circumstances surrounding the causes and categories of accidents and injuries, with the aim to minimize their occurrence within the construction industry (Samuels, 2005; [Abdelhamid](#) and [Everett](#), 2000; Perttula *et al.*, 2006), the rate of construction accidents and injuries remains unacceptably high as the volume of construction activities increases within South Africa (Ferreira, 2008). For example, for the period of April 2006 to February 2007, more than 130 construction-related deaths and over 330 injuries were reported in South Africa (Swanepoel, 2007). Consequently, it is recognised that due to involvement in construction, workers lose their lives and companies suffer loss of profit as a result of the poor health and safety performance of the construction sector. The fact that the construction industry still continues to cause death and bring harm to workers, suggests the need for alternative construction methods. The study will examine the impact of prefabrication on health and safety in construction as an alternative construction method to traditional construction method.

2. Health and safety hazards during the construction process

Construction work is performed in two different ways, namely, using either traditional construction processes or offsite construction. Offsite construction refers to prefabricated material and components fabricated and/or pre-assembled in a factory-type working environment followed by transportation to their permanent location on site. Offsite production is also recognized under various names, for example, modularization, pre-assembly, prefabrication or precast (Haas *et al.*, 2000). Conversely, traditional construction work is carried out on site through the combinations of manual labour and raw materials. Traditional construction methods are referred to as labour based, labour intensive or in-situ construction methods. Typically, traditional construction methods engage workers in activities such as, excavation, temporary or permanent formwork erection, concrete work, roofing, steel erection, screeding, ceiling erection, block laying, carpentry, plastering work, reinforcement work, painting work, and bricklaying. However, these jobs are, however, intrinsically hazardous in nature and impact negatively the health and safety of workers on construction sites. Additionally, construction site activities are, reportedly the major causes of health problems to workers (Samuels, 2005). As a result, Smallwood and Haupt (2007) indicated that, while workers were involved in trade related work such as concreting, reinforcing, formwork, structural steelwork, masonry, roofing, building fabric, plumbing and drainage/pipefitting, suspended ceilings, painting and decorating, paving and other external work, ergonomic problems were highly possible. Construction activities and labour intensive methods were fraught with various hazards and risks to workers (Baradan *et al.*, 2006). These risks differ from trade to trade or activity to activity on a daily basis (Bruttene, 2005).

Given that health and safety performance improvement on construction sites is still a goal worth pursuing, Lou *et al.*, (2008) suggested that prefabrication would improve construction site working conditions by reducing significantly work to be done on site. McKay *et al.*, (2005) added that moving work away from construction sites themselves could lead to less hazardous construction activities and, consequently, less risk. According to Pasquire and Connolly (2002) prefabrication and pre-assembly will not only improve health and safety but quality, productivity, performance, profit and the time frame for completion of the contract. Toole and Gambatese (2008) argued that prefabrication would improve overall health and safety in the construction site. Bikitsha and Ndiokubwayo (2009) found that prefabrication was flexible and it would reduce risks associated with on site construction processes. For instance, Figure 1 shows risks incurred with slab construction process done on site. Figure 1 shows a comparison of slabs built onsite and precast concrete slab installation in site. This process clarify that offsite construction reduced many hazards associated with on-site construction activities. For example, worker's involvement in manual material handling onsite associated with huge exposure to twisting, bending and repetitive lifting loads while mixing concrete could result in back injuries (Bust *et al.*, 2005) which would be reduced by offsite processes. Additionally, concrete vibrating involves workers in repetitive hand and arm vibration which could lead to hand and arm vibration syndrome (The Office of Regulatory Services, 2008). Hand-arm vibration syndrome (HAVS) develops an influence on blood vessels,

nerves and muscle on hands, arms and wrist which may result in disability if ignored (HSE, 2005). The Office of Regulatory Services (2008) indicated that anti-vibrating gloves reduce vibration. However, offsite precast concrete slab would eliminate the need for concrete vibration on site completely

It is also suggested that the construction planner or designer could determine materials and equipment handling methods for the proposed construction works which would eliminate risks associated with construction processes (Proverbs *et al.*, 1999). Clearly, the decisions during the design stage of designers directly impact on the health and safety of workers on construction sites (Rwamamara and Holzmann, 2007). Notably, the design team tends to focus on the safety of end users, with the expectation of contractors having to find their own ways of working safely (Hinze and Marini, 2008). Consequently, many accidents and fatalities occur during on-site construction processes given that construction work has a high probability to expose workers to hazards (Baradan, *et al.*, 2006). Designer's decisions, arguably, expose workers to lifting, carrying and pushing heavy materials, which present the risk of musculo-skeletal disorders and ergonomic problems (Samuels, 2005). However, Rwamamara (2007) asserted that designers could influence the improvement of construction safety by making better choices in the design and planning stages of a project. Although, the designer may eliminate hazardous activities, material and various trades which expose workers to risks of accidents, injuries and fatalities on site by considering prefabrication, Pasquire and Connolly (2002) argued that designers, typically, have little understanding to distinguish between designing for manufacturing and assembling and insitu construction methods.

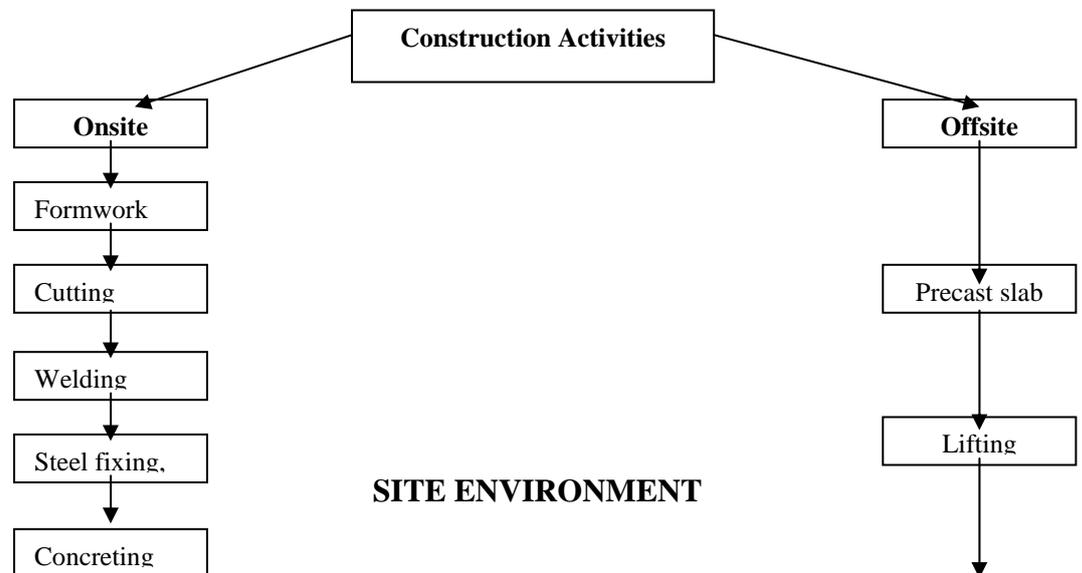




Figure 1 A comparison of risks associated with construction processes of precast and insitu concrete slabs on site

Many studies that compare in-situ construction to prefabrication off-site (Shen *et al.*, 2008; Pasquire *et al.*, 2005) found that in-situ construction activities were more hazardous (Gibb and Neale, 1997; Rwamamara, 2007; Bikitsha and Ndiokubwayo, 2009). Prefabrication was found to possibly reduce the exposure of workers to physical demanding work related to manual material handling processes (Mckay *et al.*, 2005). Hass *et al.*, (2000) and Court *et al.*, (2006) suggested that the utilization of offsite production would lead to improvements in overall project health and safety. Evidently, the use of preassembly would reduce the possible hazards that could lead to unnecessary accidents and fatalities within the construction industry. For example, McKay *et al.*, (2005) in their study found that the fatality rate and non fatality accidents in the United Kingdom construction industry were reportedly lower than those of the United States. This was one of the testimonials from the utilization of offsite production in the United Kingdom construction industry. Consequently, Gibb (2001) argued that there was a need for the construction industry to change from its current culture to offsite manufacturing to improve its overall performance.

3. Methodology

A series of research survey instruments were developed which included both open- and closed-ended questions which were targeted at designers and contractors in the Western Cape Province. These questionnaires were developed to obtain the perceptions of designers and contractors relative to the impact of prefabrication on health and safety on site. Given the difference in their responsibilities within the construction industry, similar but slightly different questions were developed for each (designers and contractors). A random sampling method was used to select contractors and designers. Results were captured and analysed accordingly.

4. Findings

4.1.1 Occupation of the respondents

Table 1 Occupation of the respondents

Occupation	Number of respondents	Percentage
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Site agent	3	23.1
Site manager	2	15.4
Health and safety representatives	5	38.4
Site foreman	3	23.1
Total	13	100.0

Of 20 distributed questionnaires to contractors, 13 (65%) were duly completed and returned.

From Table 1, it is clear that most respondents were health and safety representatives (38.4%). The median years of experience in construction of contractors was 9.1 years ranging from 2 through 40 years.

4.1.2 Comparison of hazards between traditional construction and prefabrication processes

The results of measuring and comparing the extent to which traditional construction process and prefabrication process expose workers to hazards are as shown in Table 4.5 where 0% referred to no exposure and 100% referred to maximum exposure.

Table 2 Comparison of hazards

Traditional method		Prefabrication	
Hazards	Respondents %	Hazards	Respondents %
0%	0.0	0%	15.0
10%	0.0	10%	31.0
20%	23.0	20%	23.0
30%	31.0	30%	31.0
40%	15.0	40%	0.0
50%	31.0	50%	0.0
60%	0.0	60%	0.0
70%	0.0	70%	0.0
80%	0.0	80%	0.0
90%	0.0	90%	0.0
100%	0.0	100%	0.0

From Table 2 above, it is evident that:

- 31% of respondents reported that traditional construction process exposed workers to 50% hazards;
- 31% of respondents reported that prefabrication construction process exposed workers to 30% hazards;
- 15% of respondents reported that traditional construction process exposed workers to 40% hazards; and
- 15% of respondents reported that workers were not exposed to any hazards during the prefabrication construction process whereas no one reported that the traditional construction process exposed them to no hazards.

4.1.3 Health and safety benefits of prefabrication

Relative to the health and safety benefits from prefabrication compared to on-site construction method, respondents reported as evidenced in Table 3.

Table 3 Health and safety benefits of prefabrication compared to on-site construction

Benefits	Percentage %
Reduction of environmental hazards	31.0
Reduction of material handling hazards	31.0
Reduction of mechanical noise	15.0
Reduction of chemical hazards	8.0
Safe working conditions	23.0
Less risk	8.0

From Table 3, it is evident that:

- 31% of respondents opined that the use of prefabrication would lead to reduction of environmental hazards;
- 31% of respondents opined that the use of prefabrication would reduce material handling hazards on site; and
- 23% of respondents opined that the use of prefabrication would lead to safer working conditions.

4.1.4 Reduction of hazards by prefabrication

Respondents were asked to indicate to what extent they agreed with statements on hazard reduction using prefabrication on a 5-point Likert scale where 1= Strongly Disagree; 2=Disagree; 3=Neutral; 4 =Agree; and 5 =Strongly Agree.

Table 4 Hazard reduction using prefabrication

Statement	N	SD %	D %	N %	A %	SA %	Mn	Std dev	Rank
The use of prefabrication and/or pre-assembly will reduce the need for formwork	13	0.0	0.0	0.0	69.2	30.8	4.3	0.5	1
The use of prefabrication and/or pre-assembly will reduce the exposure of workers to steel reinforcement hazards	13	0.0	0.0	7.7	61.5	30.8	4.2	0.6	2
The use of prefabrication and/or pre-assembly will reduce the need for scaffolding	13	7.7	7.7	23.1	38.4	23.1	3.6	1.2	3
Prefabrication and/or pre-assembly reduces the exposure of workers to chemical hazards on site	13	7.7	15.4	7.7	53.8	15.4	3.5	1.2	4
Reduction of construction activities through prefabrication will reduce health and safety threats associated with confined spaces on site	13	0.0	30.8	23.1	30.8	15.3	3.3	1.1	5

The use of prefabrication and/or pre-assembly will reduce the prospect of contract dermatitis	13	0.0	15.4	38.4	46.2	0.0	3.3	0.8	6
The use of prefabrication and/or pre-assembly will reduce construction falls by reducing working at height related activities	13	7.7	23.1	30.7	30.8	7.7	3.1	1.1	7

From Table 4, it was noted that:

- All respondents reported that the use of prefabrication and/or pre-assembly would reduce the need for formwork;
- 93.3% of respondents reported that the use of prefabrication and/or pre-assembly would reduce the exposure of workers to steel reinforcement hazards;
- 69.2% of respondents reported that prefabrication and/or pre-assembly would reduce the exposure of workers to chemical hazards on site; and
- 61.5% respondents reported that the use of prefabrication and/or pre-assembly would reduce the need for scaffolding.

4.1.5 Impact of prefabrication and preassembly on health and safety

Respondents were asked to indicate to what extent they agreed with statements on the impact of prefabrication and preassembly on worker health and safety using prefabrication on a 5-point Likert scale where 1= Strongly Disagree; 2=Disagree; 3=Neutral; 4 =Agree; and 5 =Strongly Agree.

Table 5 Impact of prefabrication and preassembly on worker health and safety

Statement	N	SD %	D %	N %	A %	SA %	Mn	Std dev	Rank
The use of prefabrication and/or pre-assembly will reduce ergonomic hazards on site	13	0.0	0.0	15.4	69.2	15.4	4.0	0.6	1
Off-site construction processes reduce environmental hazards	13	0.0	0.0	23.1	61.5	15.4	3.9	0.6	2
Prefabrication and/or pre-assembly reduces hazards related to material handling activities on site	13	7.7	7.7	0.0	61.5	23.1	3.8	1.1	1
Off-site construction processes reduce the risks associated with on-site construction methods	13	0.0	7.7	23.1	53.8	15.4	3.8	0.8	4
Increasing the number of workers on a project site potentially leads to difficulties in managing construction worker health and safety	13	0.0	15.4	7.7	61.5	15.4	3.8	0.9	5

Labour intensive projects expose construction workers to physically demanding activities that pose risks to their health and safety	13	7.7	7.7	15.4	53.8	15.4	3.6	1.1	6
Reduction of labour through prefabrication will lead to improvement of health and safety on site	13	0.0	7.7	38.5	38.5	15.4	3.6	0.9	7
Quality is improved through the use of prefabrication and/or preassembly	13	7.7	7.7	23.1	53.8	7.7	3.5	1.1	8
Prefabrication and/or pre-assembly reduces the exposure of workers to health and safety risks	13	0.0	15.4	7.7	61.5	15.4	3.3	1.1	9
The use of prefabrication and/or pre-assembly will lead to improvement of construction health and safety performance	13	7.7	7.7	38.5	38.5	7.7	3.3	1.0	10

From Table 5, it is evident that:

- 84.6% of respondents reported that the use of prefabrication and/or pre-assembly would reduce ergonomic hazards on site;
- 84.6% of respondents reported that prefabrication and/or pre-assembly would reduce hazards related to material handling activities on site;
- 76.9 % of respondents reported that off-site construction processes would reduce environmental hazards;
- 76.9 % of respondents reported that increasing the number of workers on a project site would potentially lead to difficulties in managing construction worker health and safety;
- 69.2% of respondents reported that off-site construction processes would reduce the risks associated with on-site construction methods and;
- 69.2% of respondents reported that labour intensive projects exposed construction workers to physically demanding activities that posed risks to their health and safety.

4.1.6 Reliability

When findings or outcomes of the research are repeatable and uniform, they are considered reliable (Wellman et al., 2005). The Cronbach's alpha coefficient for scaled responses was 0.8 which satisfied the criteria for reliability.

4.2.1 Occupations of respondents

Table 6 Occupations of respondents

Occupation	Number of respondents	Percentage
Architectural designer	6	60.0
Structural engineering designer	4	40.0

Total	10	100.0
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Of the 20 questionnaires that were distributed to designers, ten (50%) were duly completed and returned. As indicated in Table 6, it is evident that most respondents were architectural designers (60%). The median years of experience in construction of designers was 15.0 years ranging from 3 through 47 years.

4.2.2 Comparison of hazards between traditional construction and prefabrication processes

The frequency of comparison of hazards between traditional construction and prefabrication processes were ranked by mean percentage as shown in Table 5.18 where 0% referred to no exposure and 100% referred to maximum exposure.

Table 7 Comparison of hazards

Traditional method		Prefabrication	
Hazards	Respondents %	Hazards	Respondents %
0%	10.0	0%	20.0
10%	20.0	10%	40.0
20%	0.0	20%	10.0
30%	50.0	30%	20.0
40%	10.0	40%	10.0
50%	10.0	50%	0.0
60%	0.0	60%	0.0
70%	0.0	70%	0.0
80%	0.0	80%	0.0
90%	0.0	90%	0.0
100%	0.0	100%	0.0

From Table 7, it is evident that:

- 10% of respondents reported that traditional construction process exposed workers to 50% hazards while no respondents reported that prefabrication exposed workers to 50% hazards;
- 50% of respondents reported that prefabrication construction process exposed workers to 30% hazards;
- 20% of respondents reported that traditional construction process exposed workers to 10% hazards;
- 40% of respondents reported that prefabrication construction process exposed workers to 10% hazards.

4.2.3 Reduction of hazards by prefabrication

Respondents were asked to indicate to what extent they agreed with statements on hazard reduction using prefabrication on a 5-point Likert scale where 1= Strongly Disagree; 2=Disagree; 3=Neutral; 4 =Agree; and 5 =Strongly Agree.

Table 8 Hazard reduction using prefabrication

Statement	N	SD %	D %	N %	A %	SA %	Mn	Std dev	Rank
The use of prefabrication and/or pre-assembly will reduce construction falls by reducing working at height related activities	10	0.0	10.0	20.0	70.0	0.0	3.6	0.7	1
The use of prefabrication and/or pre-assembly will reduce the need for scaffolding	10	0.0	10.0	20.0	70.0	0.0	3.6	0.7	2
The use of prefabrication and/or pre-assembly will reduce the prospect of contract dematitis	10	0.0	20.0	10.0	70.0	0.0	3.5	0.8	3
The use of prefabrication and/or pre-assembly will reduce the exposure of workers to steel reinforcement hazards	10	0.0	30.0	0.0	70.0	0.0	3.4	1.0	4
The use of prefabrication and/or pre-assembly will reduce the need for formwork	10	0.0	20.0	20.0	60.0	0.0	3.4	0.8	5
Reduction of construction activities through prefabrication will reduce health and safety threats associated with confined spaces on site	10	0.0	30.0	20.0	50.0	0.0	3.2	0.9	6
Prefabrication and/or pre-assembly reduces the exposure of workers to chemical hazards on site	10	0.0	40.0	60.0	0.0	0.0	2.6	0.5	7

From Table 8, it is evident that:

- 70% of respondents (mean=3.6) reported that the use of prefabrication and/or pre-assembly would reduce construction falls by reducing working at height related activities and reduce the need for scaffolding;
- 70% of respondents (mean=3.4) reported that the use of prefabrication and/or pre-assembly would reduce the exposures of workers to steel reinforcement hazards;
- 60% of respondents (mean=3.4) reported that the use of prefabrication and/or pre-assembly would reduce the need for formwork; and
- 50% of respondents (mean=3.2) reported that the reduction of construction activities through prefabrication would reduce health and safety threats associated with confined spaces on site.

4.2.4 Impact of prefabrication and preassembly on health and safety

Respondents were asked to indicate to what extent they agreed with statements on the impact of prefabrication and preassembly on worker health and safety using prefabrication on a 5-point Likert scale where 1= Strongly Disagree; 2=Disagree; 3=Neutral; 4 =Agree; and 5 =Strongly Agree.

Table 9 Impact of prefabrication and preassembly on worker health

Statement	N	SD %	D %	N %	A %	SA %	Mn	Std dev	Rank
The use of prefabrication and/or pre-assembly will lead to improvement of construction health and safety performance	10	0.0	0.0	0.0	80.0	20.0	4.2	0.4	1
The use of prefabrication and/or pre-assembly will reduce ergonomic hazards on site	10	0.0	0.0	0.0	90.0	10.0	4.1	0.3	2
Off-site construction processes reduce environmental hazards	10	0.0	0.0	0.0	100.0	0.0	5.0	0.0	1
Labour intensive projects expose construction workers to physically demanding activities that pose risks to their health and safety	10	0.0	0.0	10.0	90.0	0.0	3.9	0.7	4
Increasing the number of workers on a project site potentially leads to difficulties in managing construction worker health and safety	10	0.0	0.0	10.0	90.0	0.0	3.9	0.3	5
Off-site construction processes reduce the risks associated with on-site construction methods	10	0.0	0.0	20.0	80.0	0.0	3.8	1.4	6
Prefabrication and/or pre-assembly reduces hazards related to material handling activities on site	10	0.0	10.0	20.0	70.0	0.0	3.6	0.7	7
Quality is improved through the use of prefabrication and/or preassembly	10	0.0	0.0	40.0	60.0	0.0	3.6	0.5	8
Prefabrication and/or pre-assembly reduces the exposure of workers to health and safety risks	10	0.0	20.0	10.0	60.0	10.0	3.6	1.0	9
Reduction of labour through prefabrication will lead to improvement of health and safety on site	10	0.0	10.0	30.0	60.0	0.0	3.5	0.7	10

and safety

From Table 9, it is evident that:

- All respondents (mean=4.2) reported that the use of prefabrication and/or pre-assembly would lead to improvements of construction health and safety performance, reduce ergonomic hazards on site (mean=4.1) and that off-site construction processes would reduce environmental hazards (mean=5.0);
- 90% of respondents (mean=3.9) reported that labour intensive projects exposed construction workers to physically demanding activities that posed risks to their health and safety;
- 80% of respondents (mean=3.8) reported that off-site construction processes would reduce the risks associated with on-site construction methods; and
- 70% of respondents (mean=3.6) reported that prefabrication and/or pre-assembly would reduce hazards related to material handling

activities on site and exposure of workers to health and safety risks.

4.2.5 Reliability

The Cronbach's alpha coefficient for scaled responses was 0.8 which satisfied the criteria for reliability.

5. Discussion

The findings suggest that traditional construction method activities are more hazardous compared to prefabrication and preassembly processes on site. This notion was advanced by Gibb and Neale (1997) and Rwamamara (2007). Similar health and safety benefits were identified by McKay *et al.*, (2005) in their study. Although Haupt (2001) reported that the construction industry earned the reputation of being a dangerous or highly hazardous industry, the literature and findings suggest that the use of prefabrication is packaged with health and safety benefits on site.

Respondents identified various health and safety benefits from the use of prefabrication and preassembly when compared to onsite construction, namely

- Reduction of environmental hazards;
- Reduction of material handling hazards;
- Reduction of mechanical noise;
- Reduction of chemical hazards;
- Safe working conditions; and
- Reduction of risks on site.

The findings supported this notion by acknowledging that the use of prefabrication would potentially reduce the exposure of workers to steel reinforcement hazards and major falls hazards associated with height related activities. Impliedly, the use of prefabrication would reduce fall hazards by significantly reducing climbing and descending activities, reduce repetitive body movements during the onsite preparation of steel for reinforcement and reduce silica dust, welding fumes and organic solvents.

Prefabrication is also acknowledged to reduce ergonomic hazards and improve health and safety performance on site. This implies that construction workers would experience less bending of their bodies and physical demanding activities during their work execution. Physical demanding activities which constitute more pains to bodies of workers is reported as a result of their involvement in traditional construction methods. Reduction of such activities was found to lead to the improvement of health and safety performance in construction sites.

Offsite construction processes reduce health and safety risks associated with traditional construction processes. Although, the installation of offsite components could pose few risks associated with the operation of automated equipments like cranes, a careful observation is essential when these components are installed. In fact the assembling of these components offsite presents an opportunity for construction industry to

change its image in terms of poor health and safety. Despite the few risks associated with installation of these components, it is noted that traditional methods of construction presents notorious activities which can be reduce by offsite processes.

The findings of this study were found to be reliable. It can therefore be concluded that prefabrication and preassembly reduced threats to the health and safety of workers when compared with traditional methods of construction. Arguably, this would change the image of construction industry with respect to health and safety.

6. Conclusion

The perceived poor health and safety performance within the construction industry has been attributed to major negative outcomes on the health and safety of workers. However, the literature suggested that the utilization of offsite production would lead to improvements on overall health and safety performance in the construction project (Hass *et al.*, 2000 and Court *et al.*, 2006). The study also suggests that the utilization of prefabrication and preassembly would lead to improvements of health and safety performance.

The literature confirmed that construction site activities were major causes of health problems to workers. Furthermore, the issues of ergonomic problems within the construction industry had been previously explored and possible factors which led to these problems had been reported. The findings suggest that the use of prefabrication and preassembly would reduce ergonomic problems associated with manual handling of heavy material. It can be concluded that prefabrication reduces ergonomic challenges and other health and safety risks associated with traditional construction method and workers are aware of these health and safety benefits. The construction industry in developing countries like South Africa needs to embrace the improvement of health and safety by prefabrication in order to shift from the current state of poor health and safety industry.

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Sustainable building awareness in the Free State Province, South Africa

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ABSTRACT AND KEYWORDS

Purpose

The primary objective of this study is to determine the level of awareness and knowledge of built environment practitioners in the Free State Province, South Africa in terms of sustainable development practices, as well as the level of participation in the process of sustainable building.

Design/methodology/approach

The study is based on a literature review of the elements of sustainable building in South Africa, as well as on the responses to a questionnaire pertaining to sustainable building. The questionnaire was distributed amongst a selected group of 97 prominent built environment practitioners in the Free State Province, South Africa and distributed by email and/or delivered by hand. The responses were analysed, evaluated and compared against the literature review.

Findings

The results of this exploratory study indicate that the level of awareness and knowledge of built environment practitioners in the Free State Province, South Africa in terms of sustainable building, is not as advanced compared to more developed countries and that there are many barriers that still need to be overcome.

Value

The findings may encourage built environment practitioners to improve their knowledge and understanding of sustainable building, and may inspire the industry to a greater awareness and improved attitude toward greener and more sustainable developments.

Keywords: Sustainable building; Green building; South Africa

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1. INTRODUCTION

The primary objective of this study is to determine the level of awareness and knowledge of built environment practitioners in the Free State Province, South Africa in terms of sustainable development practices, as well as the level of participation in the process of sustainable building.

The construction industry uses approximately half of all non-renewable resources consumed across the planet, making it one of the least sustainable industries in the world (Edwards, 2010). It has also been determined that approximately 20% of greenhouse-gas emissions are caused by the construction and the ultimate use of commercial buildings and that one of the ways to reduce the environmental impact of buildings is through the design and construction of green buildings (Mulholland and Matshe, 2009).

The South African government and the private sector are becoming increasingly conscious of the need for environment friendly building practices, and are starting to realise the benefits of acting sustainably. Still, there are few examples of green-building techniques being fully embraced in commercial property development, despite increasing governmental, media and civil-society pressure about the climate-change issue (Van Der Merwe, 2007: Online).

There has been an increased focus on both the introduction of green practices and on energy saving technologies in the construction sector and although demand for environmentally sustainable construction services is still reported as limited, construction companies appear to be expanding their portfolio of such projects (Trade and Industrial Policy Strategies, 2010).

According to Frost and Sullivan (2010), the South African market for green buildings is experiencing an upswing, but has to deal with several teething problems, which include a common misconception of the costs involved in green design and construction, as well as an overload of green information. Frost and Sullivan (2010) also state that environmental awareness and interest are rapidly increasing. This awareness could be gauged by the fact that the Green Building Council of South Africa has experienced a membership growth rate of over 100% per annum since it opened for membership in May 2008.

The South African government committed to lead by example in terms of sustainable buildings, and is planning to retrofit about 106 000 government buildings throughout the country. The process is currently underway and more than 100 buildings in Tshwane, the Western Cape and the Free State have already been completed (Van Der Merwe, 2007: Online).

2. WHAT IS GREEN/SUSTAINABLE BUILDING

“A green building should create delight when entered, serenity and health when occupied and regret when departed” - this is possibly one of the most inspiring definitions of a green building, as referred to by Srinivas (2009).

In 1987, the UN Environment Commission defined sustainable development as: “... development that meets the needs of the present, without compromising the ability of future generations to meet their own needs” (Edwards, 2010).

What is meant by the term green building? According to the United States Green Building Council, design and construction practices that significantly reduce or eliminate the negative impact of buildings on the environment and occupants are incorporated in these buildings in the following broad areas:

- Sustainable site planning;
- Safeguarding water and water efficiency;
- Energy efficiency and renewable energy;
- Conservation of materials and resources, and
- Indoor environmental quality (Yudelson, 2007).

The term green building is defined in the American Society of Testing and Materials Standard as a building that provides specified building performance requirements, without compromising local, regional, and global ecosystems both during and after its construction and life cycle (Glavinich 2008).

According to Kibert (2008) the seven principles of sustainable construction are:

- Reduce resource consumption (reduce);
- Reuse resources (reuse);
- Use recyclable resources (recycle);
- Protect nature (nature);
- Eliminate toxics (toxics);
- Apply life-cycle costing (economics), and
- Focus on quality (quality).

Kibert (2008) also states that green buildings can be defined as “healthy” facilities designed and constructed in a resource-efficient manner, using ecologically based principles.

3. LEGISLATION

Frost and Sullivan (2010) state that in spite of the upswing in the general awareness of the South African market, there remain a lack in policy, legislation and financial support which will impel companies to adopt green practices over the lifecycle of a building.

Currently, South Africa only has the South African National Standards (SANS) 204 building codes for energy efficiency, wherein compliance is voluntary. These codes are expected to be incorporated into the National Building Regulations, requiring all new construction projects to meet a minimal level of energy efficiency. While initiatives like the SANS 204 will have a positive effect on the market, the lack of large-scale legal application mandating green practices will continue to have a restraining effect on the market (Frost and Sullivan, 2010).

4. HURDLES/BARRIERS

Currently the construction industry is experiencing a lack of accurate, thorough and quantifiable information regarding the financial and economic impact of green/sustainable developments, all despite the growing recognition of sustainable practices, green products and high-performance technologies in building design and construction (Suttell, 2006: Online).

According to Kibert (2008), some of the barriers to sustainable building include:

Financial disincentives

- Lack of life-cycle cost analysis and use;
- Real and perceived higher capital expense;
- Budget separation between capital and operating costs;
- Security, and
- Inadequate funding.

Research

- Inadequate research funding;
- Insufficient research, and
- Lack of life-cycle cost analysis and use.

Lack of awareness

- Conventional thinking prevails, and
- Aversion to perceived risk.

5. RATING TOOLS

Green Star SA

The purpose of a green building rating tool is to set standards and benchmarks for green building, and to enable an objective assessment to be made as to how “green” a building is. A “menu” of all the green measures that can be incorporated into a building is set out by such a rating tool. Points are awarded to a building according to the measures which have been incorporated, and, after appropriate weighting, a total score is arrived at, which determines the rating (Green Building Council of South Africa (GBCSA), 2008: online).

According to The GBCSA (2008: online) the Green Star SA was developed, based on the Green Building Council of Australia’s Green Star rating system. The purpose of this rating system is to provide the commercial property industry with an objective measurement for green buildings and to recognise and reward environmental leadership in the property industry.

The objectives of the Green Star SA rating system are as follows:

- Establish a common language and standard of measurement for green buildings.
- Promote integrated, whole-building design.
- Raise awareness of green building benefits.
- Recognise environmental leadership.
- Reduce the environmental impact of development (GBCSA, 2008: online).

According to Davis Langdon Africa (2010), the nine categories included in the Green Star SA rating system, which assess the environmental impact as a direct consequence of a project’s site selection, design and construction are:

- Management;
- Indoor Environment Quality;
- Energy;
- Transport;
- Water;
- Materials;
- Land Use and Ecology;
- Emissions, and
- Innovation.

6. RESEARCH

A selected group of 97 prominent built environment practitioners in the Free State Province were requested to complete a structured questionnaire. This questionnaire was distributed by email and/or delivered by hand. 25 Responses were received from the selected group reflecting a 26% response rate. Of the respondents, 1 is a client, 18 are consultants, 5 are contractors and 1 is an architectural post graduate student.

All of the respondents hold tertiary education qualifications in relevant fields of the building industry and the responses indicated an even spread of years experience by the various built environment practitioners. No distinction was made between the various consultants e.g. Architects, Quantity Surveyors and Engineers.

Table 1: The sample composition of respondents

Organisation type	Respondents	Percentage
Client	1	4%
Consultant	18	72%
Contractor	5	20%
Other	1	4%
Total	25	100%

The questionnaire included questions pertaining to green/sustainable building. Rating scales based on the five-point Likert scale were used in order for respondents to rate their answer.

The responses received were analysed and compared against the literature review. This data was used to determine the degree of importance of each of the questions and to draw conclusions with regards to the respondents' opinions, attitudes and commitments toward green/sustainable building.

7. DISCUSSION

The following findings emanated from the analysis of the completed questionnaires.

Table 2 indicates the response in terms of awareness and knowledge of the concepts and methods of green/sustainable building. It is determined that the mean level of awareness and knowledge rates at 2.9 out of 5.

This shows that built environment practitioners have limited knowledge about green/sustainable practices, and that there remains a lot to be learned.

Table 2: Awareness and knowledge of the respondent

Responses	1=low					5=high					Total
	1	2	3	4	5						
Number of respondents	2	6	10	6	1	25					
Percentage of total	8%	24%	40%	24%	4%	100%					
Average rating	2.9										

Table 3 shows that the average level of awareness of green/sustainable development in South Africa rates at 1.8 out of 5, indicating that it is still in its infant stage. This could also be an indication of the many barriers that we still have to overcome in terms of green/sustainable practices in South Africa.

Table 3: Green/sustainable awareness in South Africa

Responses	1=low					5=high					Total
	1	2	3	4	5						
Number of respondents	7	15	3	0	0	25					
Percentage of total	28%	60%	12%	0%	0%	100%					
Average rating	1.8										

Table 4 shows that the incorporation of sustainable elements in projects that the respondents are involved in rates at an average of 2.5 out of 5. This serves as confirmation of the literature review, stating that South Africa seems to be lagging behind in the adoption of green building practices.

Table 4: Incorporation of sustainable elements in projects that respondent is involved in

Responses	1=low					5=high					Total
	1	2	3	4	5						
Number of respondents	3	11	7	4	0	25					
Percentage of total	12%	44%	28%	16%	0%	100%					

Average rating	2.5	
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Table 5 indicates that the mean rating for the incorporation of sustainable elements in construction projects is 2.2 out of 5. This indicates that a small percentage of projects in South Africa can be labelled as green projects. This affirms the literature review stating that there are few examples of green-building techniques being fully embraced in commercial property development.

Table 5: Incorporation of sustainable elements in projects in South Africa

Responses	1=low			5=high		Total
	1	2	3	4	5	
Number of respondents	6	10	7	2	0	25
Percentage of total	24%	40%	28%	8%	0%	100%
Average rating	2.2					

Table 6 is an indication of the awareness and knowledge of the Green Star Rating System in South Africa. 52% of respondents are aware of the system and 48% not.

Table 6: Green Star Rating System awareness

Responses	Yes	No	Total
Number of respondents	13	12	25
Percentage of total	52%	48%	100%

Table 7 shows that the majority of projects that respondents are involved in, are not rated by Green Star SA.

Table 7 Green Star SA rated projects

Responses	Yes	No	Total
Number of respondents	2	23	25
Percentage of total	8%	92%	100%

Table 8 indicates the factors which are hindering built environment practitioners from incorporating sustainable practices into their projects. The respondents rated each factor in terms of their level of impact on construction professionals.

Table 8: Factors hindering built environment practitioners and developers from regularly incorporating sustainable strategies into projects

Factor	Average rating out of 5	Ranking
Cost	4.2	1
Lack of knowledge about sustainable practices	4.2	1
Lack of knowledge about the effects of non-sustainable practices on the environment	4.1	2
Lack of training and education	4.1	2
Availability/lack of availability of green resources	3.6	3

8. CONCLUSION

Compared to developed countries' standards, the construction industry in the Free State Province, South Africa seems to be lagging behind in the adoption of green building practices. Green building has yet to reach its full force in the Free State.

There are, however, signs that a 'sustainable building philosophy' is taking hold, and that built-environment professionals are starting to make real, if modest, strides in this regard.

The fact that there is a need to go "green" cannot be argued, but how this can be achieved, is debatable. Technology alone is, by no means, the answer – a drastic change in attitude is required (Wilreker, 2011).

Currently, South Africa seems to be experiencing a lack in policy, legislation and financial support to impel companies to adopt sustainable practices over the lifecycle of a building.

Despite progress, there remain obstacles which will have to be overcome, before the market will fully embrace sustainable concepts and practices.

The Green Star SA Rating System has been established to set standards and benchmarks for green building, however few of built environment practitioners have knowledge in terms of this new rating system and very few projects are Green Star SA rated.

9. RECOMMENDATIONS

Enthusiasm is a key quality in making any changes in existing systems. The 19th century philosopher Ralph Waldo Emerson said, "Nothing great was ever achieved without enthusiasm." (Yudelson, 2007)

It is important that built environment practitioners adopt a new attitude toward green/sustainable building.

Professionals should take it upon themselves to increase their level of awareness and knowledge in terms of green/sustainable building and to incorporate sustainable practices and strategies into the projects that they are involved in. Knowledge and awareness can be increased through the organising and attendance of Continuing Professional Development (CPD) events through the respective local professional bodies.

More effort should be put into overcoming obstacles pertaining to the furthering of green/sustainable practices in the construction industry.

Legislation, policy and financial support should be put in place in order to impel developers and construction professionals to adopt green practices from as early as concept stage, till completion of construction and over the lifecycle of a building.

More in-depth research into green/sustainable practices and strategies is required in order to convince built environment practitioners to increase their level of awareness and knowledge.

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Achieving Sustainability through Refurbishment of Tower Blocks: Tenants Perspective

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Purpose: The paper has two principal aims – to investigate the impact of refurbishing tower blocks as a sustainable solution for integrating environmental and social values; and to determine whether the refurbished tower blocks were in line with tenant's expectation in terms of design and comfort.

Design/methodology/approach: Literature review is used to identify the perceived problems and benefits of refurbishment. A survey questionnaire was used to collect data from 67 tenants living in three Tower Blocks (high-rise flats) in West London. The findings are investigated using appropriate statistical tests.

Findings: The findings suggest that refurbishment as opposed to demolition was a viable option for achieving sustainability. The majority of the tenants agreed that their surroundings and way of life improved after refurbishment. Other notable benefits from refurbishment were improved security, improved social behaviour and social harmony. However, the respondents failed to neither identify nor suggest future refurbishment works that could improve their estates. Lack of consultation between the service providers and contractors with the tenants was identified as the major barrier affecting the future refurbishment.

Research limitations: The cross-sectional data made it difficult to generalise the findings.

Practical implications: The paper provides a road-map for successful and effective management of refurbishment of Tower blocks. Lesson learned include an early and systematic involvement of tenant or occupants could alleviate the problems concerning lack of support for extensive refurbishment works experienced by contractors.

Keywords: Benefits, Refurbishment, Sustainability, Tower Blocks, United Kingdom

1. INTRODUCTION

High rise blocks account for 5% to 6% of public sector housing in the United Kingdom. Many of these blocks are now more than 20 years old and need major refurbishment. The costly alternative in many cases is demolition and re-housing of the occupants. Refurbishment package featuring energy efficient measures can be a worthwhile option (BRE, 1991). Improving the energy efficiency of existing properties is hugely important to the Government's long term objectives. The theoretical potential savings in terms of carbon emissions are enormous. The targets do not prescribe how they should be achieved, although various approved measures are permitted, such as improving insulation, installing efficient lighting, appliances or boilers. One of the main drivers for Tower Blocks is to minimize the use of land. If a city center developer wants to minimize the impact on land use, the only way to expand is upwards

Thus sustainable refurbishment contributes to both energy efficiency and social renewal. Mansfield (2009a) study highlighted the contribution that legacy stock could make to various sustainability targets through sustainable refurbishment. The study found that sustainable refurbishment could provide significant financial benefits to investors and occupiers in addition to positively contributing to various sustainability targets. Another study by Mansfield (2009b) provided some measures that could be introduced to support sustainable refurbishment in the legacy stock. The improvement of domestic energy efficiency for lower income households can potentially enable them to heat their homes to a higher standard, reduce condensation and dampness, and release income for other purposes. In order to ascertain the benefits from sustainability, Tenant's views should be sought. The study by Miller and Buys (2008) aimed at exploring the social dimension of sustainability found that tenants were interested and willing to engage in discussions about sustainability initiative. However that study focused on the perspectives of commercial office building tenants. Electric heating systems should be avoided because they generally produce between two to four times the overall amounts of CO₂ emissions compared to gas central heating when the full production cycle is taken into account (Anon, 2011a). This study investigates the tenant's perceptions of the factors inhibiting or contributing to achieving the sustainability agenda through the refurbishment of the Tower Blocks. The paper also explores the benefits to be gained from refurbishment. The rest of the study is structured as follows. The following section gives an historical background of the development of Tower Blocks. This includes the background to refurbishment and problems of the Tower Blocks. The next section summarizes and presents brief discussions on the reviews of the extant literature on the contribution of refurbishment to the sustainability agenda. This is followed by the methodological approach adopted and also discusses the findings. The implications and conclusions are drawn in the last section.

2. LITERATURE REVIEW

2.1 History of Tower Blocks and Background to Refurbishment

Fifty years ago there were no high-rise buildings in London. In May 1949, a ten-storey council housing block opened in Holborn. Since then around 2700 Tower Blocks have been built in Greater London; they were seen as the way to build a better future in the 1950s and 1960s (Museum of London, 1999). They were initially welcomed for their excellent views, which made them a popular living place. However, as the buildings themselves deteriorated, they grew a reputation for being undesirable low cost housing, and many Tower Blocks saw a rising crime levels and an increase in their unpopularity. Some of the reasons for this were the great increase in the number of housing estates built in that period, which in turn brings its own problems and after the partial collapse of Ronan Point in 1968 (Anon, 2011a).

Tower Blocks in West London were built in the 1960's and are now being redeveloped. They are situated alongside each other and are popular blocks with many of the original inhabitants residing there. Although in decent condition, the blocks had not been renovated for almost 40 years. The Tower Blocks have not been maintained very well and required extensive refurbishment (Price and Myers, 2005). These blocks had problems with anti-social behavior and it was difficult to live in the flats. The need to provide residents with decent homes was a factor in the decision to refurbish. The demolition went beyond the initial expectations and therefore became more expensive whereas the refurbishment became cheaper to bring the units up to decent homes standards and to extend their life by another 30 years. Essentially this meant internal work to improve bathrooms, kitchens, heating, roof works, structural concrete repairs, and works to balconies, security, electrical wires, lifts, communal areas, staircases, and main doors of the flats (Price and Myers, 2005).

The options regarding to every Tower Block in the country is do nothing, refurbish, or demolish. The reason many landlords are facing the need to decide now is that most Tower Blocks were built between the 1950s and 1970s and though the main framework remains structurally sound, services such as lifts and heating require refurbishment. The criteria of the Contractors was to decide whether the blocks can be made viable economically, structurally, socially, environmentally for another 30 years. Factors that are taken into account include; popularity, physical condition and structure, fire safety, location and the cost of demolition. The problems that the blocks were suffering from were social decline with anti-social behavior such as vandalism/drug dealing and the lack of security. Residents were consulted on the refurbishment but don't seem to have been part of the decision-making and project management process. It is possible that most residents would not have wanted the stress of having to engage closely with the refurbishment (Church and Gale, 2000).

2.2 Problems of Tower Blocks

The National Tower Block Network (NTBN), 1984 identified the following as being the problems associated with living in a Tower Block: inadequate heating systems; lack of safety for children; tenant isolation / depression; inadequate play facilities; asbestos; lack of community facilities; poor fire

safety; racism / racial harassment; inadequate or unreliable lifts; dampness / condensation; building defects; lack of security; and poor layout / environment of estates. The study by Shabha (2003) points out that most of the high-rise flats constructed in the 1960's were characterized by inferior quality and poor workmanship, poor supervision and inadequate environmental services which subsequently deteriorated to state of disrepair. According to Church and Gale (2000), in 1992 The National Sustainable Tower Block Initiative added some more problems to the list such as: noise, litter, and refuse – problems resulting from a 'clash of lifestyles' which is less easy to escape because people are living in such close proximity; fear of crime as well as crime itself; poor reputation and stigma; allocations policies – the tenants' priority will be to get a suitable resident, but for financial reasons the landlord may simply want to let the flat as quickly as possible; enforcing obligations and responsibilities of contractors - The landlord may find it difficult to monitor performance properly.

2.3 Sustainability Development

According to the Brundtland Report, *World Commission on Environment and Development* (WCED, 1989), Sustainable development was brought into the consciousness of many international policy-makers and multinational corporations in 1987, with the publication of *Our Common Future*, the report of the World Commission on Environment and Development. Sustainable development is defined as a process that "*meets the needs of the present without compromising the ability of future generations to meet their own needs*". A sustainable development not only embraces the concept of sustainability but is, in itself, a teaching tool for sustainability. Its design addresses three main issues named the Triple Bottom Line, namely environmental impacts, social concerns and economic performance. Buildings consume large amounts of resources and emit different types of pollution. It is very crucial that buildings are made sustainable so as to reduce the damage caused to the environment. Price and Myers (2005) identified the following as environmental impact of buildings: ozone depletion; ecological loss; land depletion; climate change; ecological loss; water depletion; and acid rain.

2.4 Sustainable Refurbishment

The RICS (1998) defines refurbishment as the extensive repair, renewal and modification of a building to meet economic and/or functional criteria equivalent to those required of a new building for the same purpose. The transfer of council owned housing to housing associations and creation of Arm's Length Management Organisations (ALMO) provided routes for major investment in upgrading of this stock. Around 150,000 homes are currently transferred per year. The transfers required that homes were brought up to the Decent Homes Standard. Much higher standards should be set for upgrading, including sustainability standards for energy, water, materials and waste. Development of a national standard for sustainable refurbishment should be prioritized in the light of this opportunity (Sustainable Development Commission, 2005). However, refurbishment now forms a rapidly growing proportion of the nation's construction expenditure (Headlam, 1986). Refurbishment has recently become a more

attractive alternative to new build in the current property market (Collins, 2003). Existing building stock in the UK has a poor environmental and energy performance. The commitments to urban renewal and environmental targets, and the governments sustainable Communities Plan and Decent Homes Standard are illustrated in Figure 2.1 Sustainable housing refurbishment provides tools for integrating sustainable development and tenant participation in their refurbishment management process (Price and Myers, 2005).



Figure 2.1: Environmental Target

Source: Price and Myers (2005)

The Decent Homes (ODPM 2004b) Standard establishes four criteria that housing should meet: (1) a housing fitness standard; (2) reasonable state of repair; (3) reasonably modern facilities and services; and (4) a reasonable degree of thermal comfort. The UK Government was committed to ensuring that all social housing was decent by 2010, and to reducing the number of vulnerable households in non-decent private housing. Often, restoring an existing building may be more sustainable than rebuilding. Choice of materials for refurbishment is important as they should be compatible with the existing structure and preferably sustainable in themselves. More modern buildings can also be refurbished successfully for example concrete and steel framed buildings can be re-clad and given a new lease of life (Durham County Council, 2006).

3. RESEARCH METHODOLOGY

A research methodology based on a triangulated approach, consisting of literature review and questionnaires was employed to ensure a robust methodological design (Edwards and Holt, 2010), and to accomplish two objectives. The first part was qualitative and was conducted via a literature review which sought to investigate Sustainable Refurbishment of Tower Blocks. The second part of the study involved the collection data through

questionnaires. Prior to the administration of the main survey, a pilot questionnaire was conducted with the targeted respondents. The purpose was to obtain feedback. Piloting is also necessary as it is very difficult to predict how respondents will interpret and react to questions (Gill and Johnson 1991). The targeted population for the quantitative study was the tenants in the identified Tower Blocks in London. A total number of 80 questionnaires were hand delivered to tenants and 67 were received, thus the response rate was 83.8%. The direct delivery was preferred to motivate the respondents to participate (Nguyen *et al.* 2004). The questionnaire administered to the tenants contained 14 questions. 12 of the Questions were based on a 'yes/no' tick boxes, whereas question 11 was on a likert scale and this sought the respondents opinions on the refurbishment and maintenance and 1 question was open ended.

4. RESULTS AND DISCUSSIONS

The following section presents the results of the tenant's perspective.

4.1 Period of Occupancy

This was used to obtain general information about the period that tenants lived in Tower Blocks in order to assess the importance of the responses. Table 4.1 presents the demographics of the respondents by the period of occupancy in the tower blocks.

Table 4.1: Period Living in Towers

	Period Living in Tower (Years)					
	1-5	5-10	10-15	15-20	20-25	25+
No. of Tenants	15	18	16	3	5	9
Percentage	22%	30%	24%	4%	7%	13%

Table 4.1 shows that there is a wide spread of the period the tenants have lived in their flats. Over 75% of tenants lived in their flats for more than 5 years. This background information regarding the tenants supports the underlying assumptions that they had enough experience and background of the tower blocks such as before and after refurbishment, and could provide competent answers related to the environment, and social behavior.

4.2 Problems before and after refurbishment

In order to investigate the potential benefits of refurbishment among the tenants, the quantitative part of the questionnaire asked the tenants whether they had major problems before the refurbishment. 46 tenants responded to this question whereas the remainder (21) opted not to answer. The 46 respondents mentioned the major problems they had before the refurbishment. These include inadequate heating system, poor kitchen, poor windows/doors, old bathrooms, poor security and unreliable lifts. However the same number (46) indicated that they had a better life

and decent homes after the refurbishment. It can also be inferred that the remainder of the respondents 21 (31%) that chose not to respond might have ignored the improvements made to their homes.

However, 31% of respondents pointed out problems after refurbishments such as poor quality materials, poor workmanship and uncompleted minor works left by subcontractors as they were not mentioned as problems before the refurbishment work. The results suggest that the residents were generally satisfied with their new surroundings. However, according to Price and Meyer (2004), the 'National Tower Block Network' (NTBN) also identified other problems that cannot be overcome by refurbishment but through a change of social attitudes such as: inadequate heating systems; lack of safety for children; poor fire safety; and Lack of security and racism and racial harassment.

4.3 Tenant's Perception of time and programme.

The tenants were also asked whether the refurbishment was convenient to their time and programme. The majority 49 (73%) of the respondents believed that the time and programme of the refurbishment process were convenient to them whereas 27% found the refurbishment was not convenient. The lack of general consensus on the timing is supported by (Church and Gale, 2000) who observed that in relation to timescales, "providers and receivers of services have different expectations about what constitute reasonable timescales for the provision of services".

4.4 Improved Security

The tenants were also asked whether the security had improved following the refurbishment. The results are shown in Table 4.2 below.

Table 4.2: Respondents perceptions on Level of security after refurbishment

Level of Security	Number of responses	% of respondents
Security improved	34	50.75%
Security did not improve	25	37.31%
Don't know	8	11.94%
Total	67	100.00

Examination of the Table (4.2) reveals that nearly half (50%) of the respondents believed that the security had improved following refurbishment. However, 38% believed that the security has not improved and about 12% did not know. This finding is consistent with literature as evidenced by the study such as NSTBI (2000) first report which noted that security measures such as CCTV can also help create a less favorable environment for crime in the surrounding area. Some earlier studies had reported the fear of crime as well as crime itself as one of the problems facing tower blocks.

4.5 Way of Life

Furthermore, the respondents were asked whether refurbishment had improved the way of life. A large proportion (74%) of the respondents believed that the area had improved according to what they had experienced. Their living style is considered as the way of living inside which many believed had improved into a decent standard. This finding may be due to the fact that the majority of these tenants had lived in their flats for a number of years as illustrated in Table 4.1. However a minority (24%) believed that this was not an important consideration. These respondents may prefer to have the Tower Blocks demolished than refurbished. This is in line with the government's sustainable communities plan for providing Decent Homes Standard (CPD - 2004)". However, 22% believe that the renovation has not improved their lifestyles. These respondents may not be aware of the new services the government provided.

4.6 Refurbishment or Demolition

The tenants were also asked whether they preferred refurbishment as opposed to demolition. The majority 79% (53 respondents) were in favor of refurbishment. Only 18% (12 respondents) believed that demolishing and building new houses were the best option given that the building was very old and would not last. Only a minority 3% (2 respondents) stated that they didn't know which one was the best option. It is noted that couples without children and elderly people (over 50 years old) who stayed in the block for a number of years did not prefer demolition. They believed that the new houses or new build would be much smaller floor area than the existing flats.

On the contrary, families with children preferred demolition as they are concerned about high rise buildings in case of fire and broken lifts; thus prefer to build new houses with gardens. This finding is consistent with literature. For example the National Tower Block Network (NTBN 1984), observed that "Tower Block accommodation is not suitable for families with children and this leaves two main options: young people without children, and middle-aged or elderly". The support for refurbishment is further provided by Highfield (2000) who observed that the work required to refurbish an existing building will normally take considerably less time than the demolition of a building, site clearance and construction of a new building. Riley and Cotgrave (2004) also note that improving the image of the refurbishment industry is a vital task that must be considered when sustaining construction and environment. The research undertaken by BRE suggests that from an environmental perspective, refurbishment is the best option.

The overwhelming support for refurbishment is obvious as it [refurbishment] currently accounts for a considerable proportion of the construction industry's workload and this is likely to increase in the future as building owners and developers embrace the principle of sustainability development whilst seeking the most cost effective ways of providing modern accommodation. Furthermore, the cost of refurbishing is generally considerable less than the cost of demolition and new construction since many of the building elements are already constructed.

4.7 Satisfaction with Refurbishment

Tenants were asked whether they were satisfied with the improvement to their flats after refurbishment. The results indicated that the majority 86% (58 respondents) were satisfied with improvements made to their flats as a result of the refurbishment made to the Tower Blocks. Only 14% (9) were not satisfied. This finding is encouraging for the refurbishment industry.

4.8 Quality of Refurbishment

Tenants were asked whether they were satisfied with the quality refurbishment. More than 60% of tenants believed that the quality of refurbishment work was high. This may be due to the comparison with the flats before refurbishment. However, 23% indicated that the quality of the refurbishment is low. This may be due to the poor quality of the materials and workmanship of subcontractor.

4.9 Priorities from Refurbishment and Maintenance

Tenants were asked to rate their opinion from a range of priorities to be fulfilled from the refurbishment and refurbishment. The results of the response are shown in Table 4.3.

Table 4.3: Respondents perceptions on the priorities from Refurbishment and Maintenance

Priorities	Frequency of Response (%)		
	High	Low	Don't Know
Improved Security	62	20	18
Improvement to the Flats	76	12	12
Improved Structural Aesthetics	53	18	23

Table 4.3 illustrates that all respondents answered high of the various aspects regarding the improvements of security, flats and the structural aesthetic appearance. Improvements to the flats were rated much higher than security (62%) and structural aesthetic appearance (53%). However these results indicate that improving an existing building is an important need and there are more urgent needs that existing building would first like to see refurbished through public funding hence "Refurbishment, rather than redevelopment is currently seen to be the more sustainable option because the amount of new build work is reduced (Riley and Cotgrave, 2004). "A central issue that is now at the heart of the regeneration debate is the Government's 'Communities Plan', launched in February 2003 and defined in the document that "Sustainable Communities: Building for the future". This Plan sets out a programme of action "for delivering sustainable communities in both urban and rural areas" this include Tower Blocks (DTI)".

5.10 Improvement in Social Behavior and Harmony

Respondents were asked whether the refurbishment of the works had improved social behavior and social harmony. The results indicated that the majority of the respondents believed that refurbishment had led to an improvement of social behavior and social harmony. However, 50% of respondents believed that the refurbishment has not improved social

behavior while 25% believe that refurbishment has improved behavior and 25% do not know whether there is improvement in social behavior. However "Tower blocks can provide security from crime. So long as the problem stems from individuals living outside rather than inside the block, then it can be kept out. Security measures such as CCTV can also help create a less favorable environment for crime in the surrounding area (NSTBI - 2000)".

5.11 Future of Refurbishment

Residents were asked to suggest future refurbishment works that may help to improve their estate. The majority of the respondents (62%) did not know what to suggest. This may be due to the lack of consultation between contractors and residents for the refurbishment works of improvement to their estate. However, 37% of respondents suggested installation of CCTV cameras throughout the blocks included floors, communal areas, lifts to prevent anti-social behavior (e.g. drug dealing) and employ security guards.

7.0 DISCUSSIONS AND CONCLUSIONS

This paper discussed the environmental impact of the sustainability development on economic, environmental, and social issues; to achieve sustainability through the refurbishment of Tower Blocks. The research survey taken from the tenant's perspective confirmed that to refurbish their flats was the best option taken by the local authority to improve Tower Blocks. The recent refurbishment of Tower Blocks actually reduced the cost to the local councils, maintained local communities, kept families together and sustained the environment.

The results of the tenant's survey were also positive in that most of the respondents agreed that their surroundings and way of life had improved. In addition security was a big issue concerning the respondents. Relative to the timing and programme of the refurbishment works, the respondents (working tenants) commented that it were not convenient due to their working days. It could thus be concluded that all buildings could be more sustainable, although refurbishment of existing buildings is essentially seen as more sustainable than demolition and construction new houses. This plays an important role in making any existing building sustainable. The study also established that the key to achieving high quality sustainable refurbishment is to look at the client's needs through consultation with tenants. Tower Blocks can be made totally sustainable; the difficulties are principally economic and social rather than technological. Economic barriers include capital costs for renewable energy sources and market acceptability, whilst social considerations include visual impact, novelty and safety.

8.0 RECOMMENDATIONS FOR FUTURE REFURBISHMENT

In order to meet the requirements of the sustainable refurbishment, the following recommendation are suggested:

- Safety is a top priority for any community. Improved security measures can deter crime and vandalism, and therefore reduce maintenance cost. This can be addressed by caretaker and CCTV systems, there will

be recognition that blocks can become more secure than other housing types, and as such can be an attractive housing option in locations where personal security is a concern. This will attract many people by certain high rise blocks where there will be a waiting list to high rise buildings in future.

- Attractive Tower Blocks should have effective security systems
- Change and improvement are dependent on successful and responsible tenant and neighborhood management
- Attractive Tower Blocks have effective management
- Successful Tower Blocks have an allocations policy that helps build a steady and suitable population
- High-rise housing can be helpful to regenerate our cities and demolition of inner-city high-rise buildings should not be considered until a full assessment of refurbishment options have been considered
- There should be a more calculated approach to refurbishment in order to maximize local sustainability
- The Government should acknowledge the value of Tower Blocks, develop a clear policy and review current mechanisms of finance
- Local authorities and regeneration agencies should also acknowledge their value and should create more sustainable management practices
- An early and systematic involvement of occupants could help to avoid problems concerning lack of support for extensive refurbishments currently encountered by builders. They play an important role in a refurbishment process which includes the phases of first decision, stock check, rough planning, detailed planning, call of tender, decision and construction phase.
- Knowledge and experience of occupants is of very high value for the housing Companies management. Residents are familiar with problems in their settlement and their own flat so they know the most important areas for the refurbishment process.
- Tenants groups representing Tower Block residents need to get organized, to make best use of available support and training, and to play a full part in any discussions about the future of their blocks.
- Contractors should work with residents and local councils to develop neighborhood management systems as a cost-effective ways of delivering quality of life improvements.
- Local authorities should recognize the potential value of Tower Blocks and review the future of blocks under their control with a view to more sustainable management practices.

- No Tower Block of satisfactory construction should be demolished without the carrying out of a rigorous option study.
- Local authorities should continue to priorities ensuring that basic needs (for a secure home, with adequate facilities and affordable heating) are being met for all residents.
- Refurbish rather than redevelop to reduce materials demand
- Energy efficient measures should be considered with other none (energy) measures when a major refurbishment is planned, and not in isolation or as an afterthought.

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Water Conservation Technologies in South Africa's buildings

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ABSTRACT

Purpose: The paper presents a pilot study on availability of water conservation technologies for buildings and their adoption in South Africa.

Research Approach: A review of existing water conservation technologies and water use policies in buildings in South Africa is presented. This is followed by an analysis of results from a pilot study on the availability and nature of dispersal of the water conservation technologies in buildings in South Africa.

Findings: The paper reveals that policies guiding water consumption and conservation in buildings are inadequate. Knowledge levels amongst suppliers, clients and their agents on water conservation technologies were found to be inadequate.

Research limitations / Implications: The research presented is a pilot study as a first step. The study is also limited to the Johannesburg area of South Africa and built environment professionals sourced through a generally more convenience sampling approach. Thus an in-depth study based on the preliminary findings would be appropriate.

Practical Implications: The study is part of a wider research but presently serves as springboard for assessment of technology adoption and transfer issues; which could be instrumental in structured introduction of water conservation technologies in buildings, within South Africa.

Originality / Value: South Africa is a water scarcity country. Disparities exist between the actual consumptions and per capita uses of water across various types of buildings in the country. As such it is of inherent importance to examine the available technologies in water conservation in buildings and their adoption. The study so far could be a useful resource in informing policy formulations in water consumption and conservation, tariff design and structure in buildings.

Keywords: water conservation technologies, buildings, policies, technology adoption, technology dispersal, built environment.

1.1 BACKGROUND TO THE SA's WATER SCARCITY STORY

Water conservation is increasingly becoming of great importance worldwide. In South Africa, the situation is worsened by the fact that the country is water scarce (Otieno and Ochieng, 2004). South Africa is largely reliant on surface water supply mainly from construction of dams and by inter-basin transfers of water to areas of high demand (Creemers and Pott, 2002). In addition, South Africa is largely arid and characterised by variable rainfall, unevenly distributed (AMCEN/UNEP, 2002). This is further exacerbated by a growing population with increasing economic activities. Mid-year population estimates for South Africa in the period of 2005–2006 is stated as averagely 1.06% (Statistics South Africa, 2006). This growth rate is against the background of a government welfare based policy of the need to address water supply provision backlogs. These factors amongst others underline the key strategy for addressing the need to adopt water conservation across all sectors in South Africa. In buildings especially, considerable efficiency could be achieved via sound implementation of strategies. Informed demand management strategy as envisaged by the United Nations Economic and Social Commission for Western Asia, is an example of such strategy (UNESCWA, 2002).

The above context sets the stage for the need to encourage use of conservation technologies in buildings, in South Africa. The study presented here attempts to analyse the issue of water conservation technologies in buildings. This aim is carried out through further review of relevant literature and a pilot. Being part of an on-going study, the research question at this stage reads thus:

What are the water conservation technologies in buildings and associated dispersal pattern in South Africa?

In furtherance of the study, review of literature investigates water consumption levels and conservation strategies in South Africa's buildings; followed by savings potentials associated with using water conservation technologies in buildings; and an outline of patterns associated with use and adoption of water conservation technologies in South Africa's buildings.

2.1 WATER CONSUMPTION LEVELS IN SOUTH AFRICA's BUILDINGS

Water consumption levels in buildings vary according to the type of buildings, usage of buildings, occupancy and culture of the occupants. As an example, Table 2.1 illustrates some indicative water consumption demand levels established in South Africa (CSIR, 2003; Veck and Bill, 2000):

Table 2.1: Indicative Water Consumption Demand Levels by Building Categories

Building Categories	Water Demand	Source
Day Schools	15-20 litres per pupil per day	CSIR (2003)
Boarding Schools	19-140 litres per pupil per day	CSIR (2003)
Hospitals	220-300 litres per bed per day	CSIR (2003)
Outpatient Clinics	5 litres per bed per day	CSIR (2003)
Community Halls/Restaurants	15 litres per user seat per day	CSIR (2003)
Middle Income Urban Households based on Study at Alberton	756 litres per Day	Veck and Bill (2000)
High Income Urban Households based on Study at Alberton	921 litres per Day	Veck and Bill (2000)
Low Income Urban Households based on Study in Thokoza	658 litres per Day	Veck and Bill (2000)

Source: CSIR (2003) and Veck and Bill (2000).

Deducing from Table 2.1, economic status seems to influence water consumption levels in society. Thus low income residential buildings tend to consume approximately 71.5% of the amount consumed by the high income residential dwellings.

3.1 WATER CONSERVATION STRATEGIES

General water conservation strategies embrace a combination of measures involving water resources management, distribution management, consumer demand management and return flow management. Among strategies mentioned, distribution management and consumer demand management are highly significant in buildings. Distribution management involves pressure management, metering, preventive maintenance, infrastructure optimisation, loss minimisation and dual distribution systems. Similarly, consumer demand management involves social awareness and education, retro-fitting, effective pricing, effective billing, loss minimisation (repair of leaks), and regulations (Department of Water Affairs and Forestry (DWAF), 2000). In the case of these aspects of the strategy, all activities are centred at the user end, which occurs in buildings.

3.1.1 Water Conservation Technologies

Water conservation technologies for the purpose of this paper refers to the use of plumbing devices or system designs that serves the purpose of the

required water service delivery in buildings using reduced quantities of water. The paper focuses on water conservation technologies in use in buildings; these include water saving faucets, showerheads, toilets, urinals, water saving washing machines, and water saving dishwashers.

An example of the depth and advancement of commitments to water conservation technologies is the case of United States (US) Federal Government goals on water conservation. Commitment by the US government to increased water efficiency was expressed in the Executive Order 13123. This order constitutes a high powered directive for federal agencies to reduce their potable water consumption by implementing all cost-effective water conservation measures in Federal facilities by 2010 (United States Department of Energy, 2002). The strategy was to firstly determine their baseline water use in 2000 and thereafter a biannual water usage report would follow. Additionally, there would be an implementation of at least four of 10 cost-effective Best Management Practices for water conservation at up to 80% of their facilities by 2010 (United States Department of Energy, 2002). Table 3.1 outlines water savings potentials realised as a result of the legislative framework; set to encourage water conservation technologies in facilities using domestic fixtures.

Additionally Table 3.1 compares standard water use (pre-1990 usage) trends associated with various devices; to trends associated with usage of modern water conservation technologies (2000 efficient models), available for use in buildings. Buildings are a primary channel of pipe-borne water usage. Consequently, in building operation lies the inherent risk of wastage. Therefore buildings constitute primary adoption area for water conservation principles and technologies. The use of water conservation technologies in buildings for toilets, showers, washing machines, basins, baths and taps could lead to realisation of enormous saving potentials as shown in Figure 3.1. Benefits accruing from each type of usage are ranked above half (50%) of usage without facilitated conservation.

From Table 3.1 and Figure 3.1 below it would naturally follow that the use of water conservation technology devices in buildings would be a natural phenomenon. However, this is not necessarily so due to complications arising from perceptions on aesthetics, lack of information on the part of stakeholders and the fact that water is considered cheap and abundant.

Table 3.1: Water Usage Rates for Domestic Fixtures in the US (Rates in litres per minute).

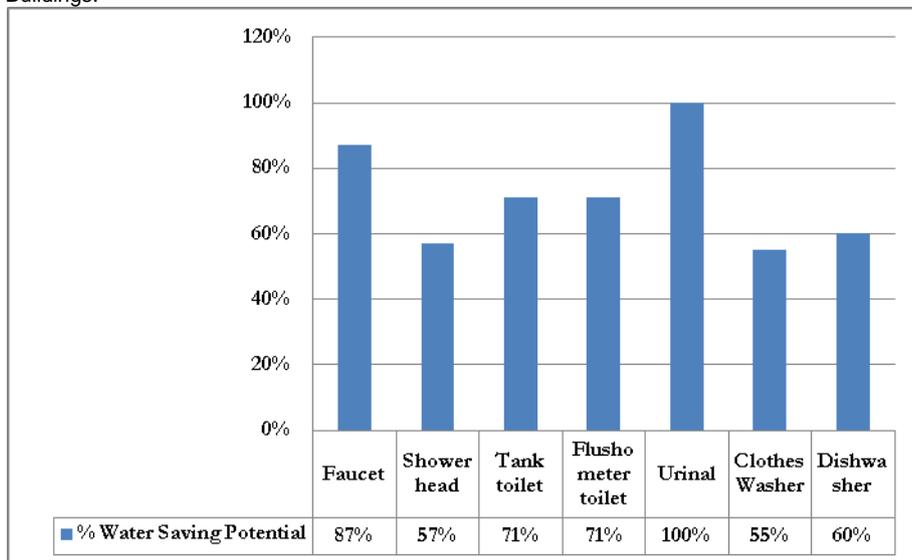
Water Conservation Technology	Pre-1990 Usage	Pre-EPA Act Usage	Pre-EPA Act Requirement	2000 Efficient Models
Faucet	18.9-26.5 lpm	15.1 lpm	9.5 lpm	1.9 lpm
Showerhead	17-30.3 lpm	13.2 lpm	9.5 lpm	5.7 lpm
Tank toilet	15.1-26.5 lpf	13.2 lpf	6.1 lpf	3.8 lpf
Flushometer toilet	17 lpf	13.2 lpf	6.1 lpf	3.8 lpf
Urinal	13.2-18.9	15.7 lpf	3.8 lpf	Waterless

	lpf			urinal
Clothes Washer		208.2 lpu	170.3 lpu	94.6 lpu
Dishwasher		37.9-56.8 lpu	37.9-56.8 lpu	17-22.7 lpu

Key: lpm: litres per minute
 lpf: litres per flush
 lpu: litres per use

Source: United States Department of Energy, 2002

Figure 3.1: Percentage Water Saving Potentials Associated with use of Water Conservation Technology Devices in Buildings.



Source: Adapted from US Department of Energy, 2000

3.1.2 Water Conservation Technologies in South Africa

As highlighted in (Still *et. al.* 2008), approaches to water conservation technology adoption in South Africa are generally limited in scope. Water conservation technologies practised in South Africa's buildings include replacement of automatic flushing urinals, use of displacement devices in large capacity toilet cisterns, use of infrared operated taps and urinals. In addition there is limited use of early generation water efficient cisterns, taps and showers in institutional set up. Notably, adoption of water conservation technologies in buildings within the South African context of has largely occurred in the public and institutional set up (Still *et. al.*, 2008).

The pattern of water conservation technology adoption locally could be because the institutional framework. The presence of institutional framework implies administrative muscle / capacity, to push through objective reforms needed for water conservation agenda. At the same time adoption of green architecture principles goes together with usage of water conservation technologies. This is especially in institutional / public buildings, which could encourage good business in certain cases. Thus green principles / energy conservation principles cannot be adequately pursued without water conservation. This assertion refers to building design, production, operation and regulation. Hence the question remains:

“To what extent are these technologies adopted?”

Basically the paper ascertains if there is technology transfer / dispersal occurring adequately in this regard.

4.1 RESEARCH DESIGN FOR FIELD INVESTIGATIONS

The study presented is a pilot from an on-going research. Thus a limited field work guided by further review of relevant literature was carried out. Interviews and a survey based on convenience sampling were used for data collection at this stage. From preliminary findings, two main scenarios of technology adoption emerged (clients and retailers), which were investigated. Further review of literature during investigations looked at technology adoption and dispersal; and policy instruments for water conservation technologies.

4.1.1 Sample Population Demographics

A survey was done on clients visiting 3 outlets for plumbing and general hardware shops. The survey targeted clients purchasing plumbing fixtures. The clients were largely home owners keen on improving their kitchen, toilet and bathroom facilities. 5 clients per hardware store were surveyed, totalling up to 15 clients. Close to 40% of the participants in the clients' survey were plumbers running small scale enterprises with some registered as Grade 1 and 2 contractors with the Construction Industry Development Board (CIDB). Shop attendants in the 3 retail outlets for plumbing fixtures were interviewed on the water conservation technologies available for offer. A total of six attendants (two from each outlet) were interviewed.

5.1 FINDINGS AND DISCUSSION

5.1.1 Available Water Conservation Technologies

Water conservation fixtures on offer at the retail outlets include dual flush toilets, bath basins and showers. Other items like waterless urinal, ultra red rays-controlled taps, water efficient dishwashers and water efficient laundry machines were not in stock in the outlets. The source of water conservation fixtures sold in the outlets was mostly from Taiwan, Europe and the United States of America.

5.1.2 Results of Clients Survey

The survey revealed that the clients purchasing plumbing fixtures for residential buildings were mainly guided by costs, aesthetics and style and not water conservation technologies in their choice of products. Further to this only 13% of the respondents confirmed that they had prior knowledge of water conservation plumbing fixtures. The respondents who had some knowledge of water conservation fixtures admitted their source of information was through the internet followed by interactions with plumbing hardware shops.

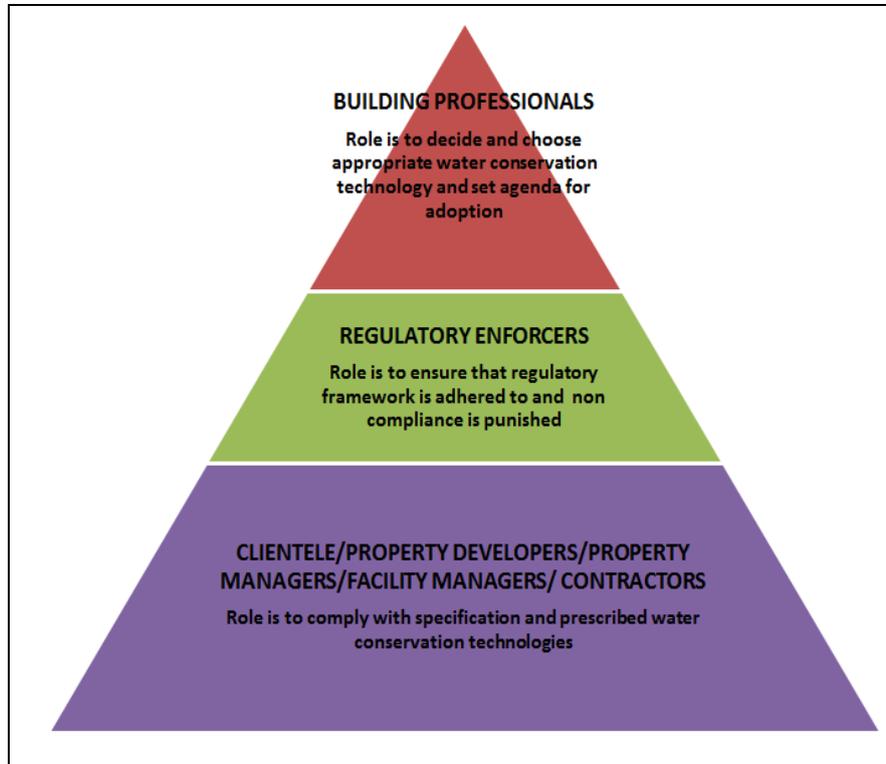
5.1.3 Results of Interviews with Shop Attendants

All the attendants agreed that they would not go out their way to offer the clients water conservation plumbing fixtures at the onset of the engagement. Respondents intimated their preference to advice clients based on stated needs. This would mean that advice on options in water conservation fixtures is given only on request by client.

5.1.4. Technology Adoption and Dispersal Pattern

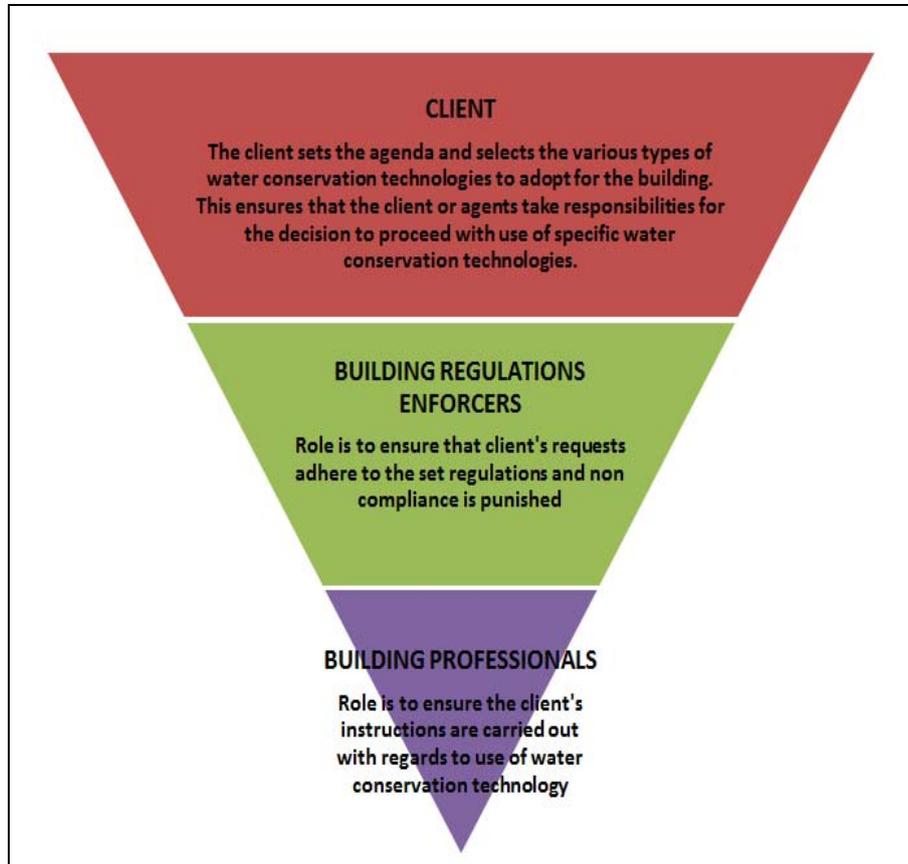
Assessment of success in technology adoption is best given by the users of the technology in question; in addition to the pattern of adoption in target population (Aduda, 2002). Current technology dispersal pattern in the study is in the form of top-down approach or prescriptive pattern as described in the paper (refer to Figure 5.1). In this mode of dispersal professionals ply the role of recommending the use of water conservation technology. Retail outlets would then dispense equivalent or exact specifications. The prescriptive dispersal pattern relies on the professional seated at the top of knowledge pyramid, who prescribes solutions based on water conservation technologies to stakeholders. Investigations at this stage indicate reluctance to recommend / adopt water conservation fixtures, on the part of respondents. This is synonymous with lack of confidence in associated technologies. At this stage, the only technology dispersal mode is prescriptive in nature.

Figure 5.1: Prescriptive technology dispersal pattern



An alternative technology dispersal mode could be the bottom up or self-sustaining dispersal strategy (refer to Figure 5.2). To achieve a self-sustaining dispersal, water conservation technology must reach a particular threshold in terms of the number of adopters. This could be achieved through continued marketing, advocacy and policy development, economic campaign and technical assistance (Still *et. al.* 2008 and Aduda, 2002). Marketing and advocacy would entail the use of media to educate the stakeholders on challenges and benefits of water conservation. This would be accompanied by appropriate supportive policies for use of water conservation technologies in buildings. Economic campaigns would encompass issues of pricing changes, tariffs and penalties. Technical assistance campaign would include the reduction of supply pressures, training of technicians and other building services experts.

Figure 5.2: Self-sustaining technology dispersal pattern



5.1.5 Water Bylaws as a policy instrument in encouragement water conservation technologies

The farthest reaching policy instrument in place for regulating, encouraging and entrenching water conservation technologies is the water services bylaws, enacted by various local authorities. The Department of Water Affairs and Forestry issues model bylaws for adoption of water services by the local authorities. This is done under the auspices of the Water Services Act 108 of 1997. The model bylaws discuss the following issues essentially (Republic of South Africa, 1997):

Municipal consent for new installation; Standards and quality for installations; Powers of municipal authority to prevent wastage and impose restrictions; Requirement of annual water audits to be performed by water users of more than 3650 kiloliters per annum; Water demand management (water saving measures); and Offences and associated penalty clauses.

It is noteworthy that in greater Johannesburg area, the city of Ekurhuleni has bylaws which give limits for cistern volumes and shower flows, outflow

automatic flushing urinals and are generally up to date regarding water conservation. However the City of Johannesburg Metropolitan Municipality does not have bylaws in place. Other municipalities are apparently silent on the subject. In reality it is highly unlikely that municipal building inspectors have time to adequately police these provisions, especially when the neighbouring municipalities have up to date bylaws on water conservation technologies or policies.

6.1 CONCLUSION AND RECOMMENDATION

Within limits of the pilot study here presented, deductions lead to a preliminary conclusion. Lack of awareness on the part of clients and inability to recommend on the part of retailers; points to certain suggestions. These deductions together become the working hypothesis:

Current measures put in place by stakeholders in South Africa, to encourage the use of water conservation technologies in buildings do not go far enough. South Africa needs to invest much in marketing, advocacy and policy formulation of water conservation technologies.

Avenues, which should be pursued in furtherance of water conservation technologies, include but are not limited to: Rationalisation of municipal and local authority bylaws to ensure uniformity and consonance with the need to encourage adoption of water conservation technologies. Government and related agencies could engage on economic based policy instruments that involve price subsidies, penalties for non-compliance and compliance based billing. Another approach to encourage adoption of water conservation technologies in buildings would be to use the existing professional bodies like the South African Property Owners Association (SAPOA), South African Architectural Professional Council (SACAP) and Engineering Council of South Africa (ECSA) to popularise and make the technologies part of design considerations from conceptualisation stage. This could in effect lead to a top down approach to the adoption of water conservation technologies in buildings (refer to Figure 5.2).

In reality a combination of the bottom up and top down approaches is essential to achieve successful water demand management via the use of water conservation technologies in buildings. Thus at this stage of the research, it is suggested that a plethora of actions would be necessary to achieve water conservation and demand management in buildings. Actions would involve sustained marketing, advocacy, regulatory policy frameworks, economic type subsidies and technical assistance by the stakeholders. All stakeholders should participate. Non-governmental bodies and research organisations could be used to set the water conservation agenda and ensure that focused is maintained during implementation.

As indicated some preceding sections, the paper presents a pilot from a wider research effort. Limitations of time, availability of respondents and consent were imposed on the research. The need for furtherance and increased depth is being addressed in the continued effort. Nevertheless deductions at this stage provide insight to some salient issues of water conservation and adoption of existing technologies in South Africa.

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The Development of Sustainable Private Retirement Villages: Establishment of Resident Preferences and Development Directives

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ABSTRACT

Purpose

This study was undertaken to establish fundamental guidelines in support of the development of sustainable private (not subsidised) retirement villages.

Design/methodology/approach

This study is based on comprehensive questionnaires that provide substantial quantified and qualitative data. A seminar was conducted subsequent to the completion of questionnaires to support quantified data. Qualitative data was obtained from the seminar and from a literature survey.

Findings

Residents of retirement villages have measurable preferences regarding what villages should provide. Literature provides qualitative guidance towards formulating optimal villages.

Research limitations/implications

The research was conducted in the eastern suburbs of Pretoria, South Africa (one of the wealthiest areas in the country). The data collected probably reflects the national situation. It is presently being extended to other centres.

Practical implications

The research facilitates the creation of guidelines for the development of sustainable private retirement villages.

Originality/value

This is the first known study that attempts to create development data that adds value to the structuring and construction of sustainable private retirement villages. The value of this research is primarily centred in assisting developers and prospective buyers to avoid non-sustainable developments.

Keywords: Development directives, housing, measurable preferences, private retirement villages, resident preferences.

1. INTRODUCTION AND METHODOLOGY

Private retirement villages (unsubsidized) have been in existence in South Africa for approximately three decades. During this period certain laws have been introduced as well as the format and ways of delivering retirement villages to the market. As can be expected there were successful developments as well as failures.

The research described in this paper adds to the creation of a knowledge base that will contribute to the decision making process of developers of retirement villages, as well as to the understanding and selection of retirement villages most suitable to individual prospective buyers' needs. The methodology used is primarily focussed on the gathering of quantified and qualitative data obtained by way of questionnaires, completed during structured meetings. A seminar attended by the chairpersons and managers of retirement villages was conducted to explore "democracy in design" information, in other words, which aspects of retirement villages function optimally, to what may be regarded as failures.

As quantified data regarding this specific field of study is a rare commodity, most of the information and reported findings in this paper is based on primary data generated during the research process.

The literature survey executed has necessarily been conducted from the perspective of this study, namely: "Undertaken to establish fundamental guidelines in support of the development of sustainable private retirement villages".

Although this research has been conducted in South Africa, the methodology and content should be of value elsewhere. The terminology retirement village, resort, estate or centre is used synonymously in the "private retirement village" domain.

It is further noted that the terminology trustees and body corporate is used synonymously. Although legally not prescribed, owner residents are normally elected by the residents as the "management committee". Practically it is the persons, usually owner residents (it does not legally have to be) elected by the residents as the "management committee". They would in turn typically appoint a salaried manager to manage the village. The latter is referred to as the managers of villages in this paper.

2. OBJECTIVE

The objective with this study is to create guidelines regarding what constitutes a successful and sustainable private retirement village; in the interest of developers and prospective buyers.

3. LITERATURE OVERVIEW

The research conducted for this study finds itself in a territory about which very little has been published. "Sustainable private retirement villages" for all practical purposes have been in existence for less than three decades. Significant development took place in the last two decades. This time scale, with the resident population now having moved into average age groups above 80, is magnifying what is sustainable, and what is not. Very importantly, the jury is still out regarding some new or envisaged elements which may be of extreme importance, which have not as yet been tried and tested. Aspects that need serious consideration regarding "sustainability" could be placed in a variety of compartments. Some covered in this study is healthcare from the perspective of "wellness" and "longevity". Financial sustainability according to all indicators is rapidly becoming a serious problem. The elderly simply cannot afford to sustain their life styles and personal care. Life supporting services and goods become more unaffordable as time passes however, needs are increasing all the time. Thus, sustainability regarding personal health needs, nutrition, services such as electricity, water, sanitation, gas and general maintenance, simply outstrips the ability of the elderly to afford it.

Development guidelines, even if informal, in the traditional subsidized (by government and welfare organisations) "old age home" environment were well established. These developments are fast becoming historic remnants with few, if any new projects being launched. The emphasis has thus shifted almost completely to private retirement villages. However, development guidelines are by no means entrenched and proven, making it repetitive experimental projects, unfortunately with noteworthy and sometimes scrupulous deficiencies entrenched. Some developments could even be classified as representative of "criminal neglect". Prospective buyers will shortly be able to take comfort from the Consumer Protection Act which will assist them with recourse against blatant "developer non-performance". However, that still does not solve the problems associated with the creation of so called retirement villages that are simply unsustainable. The creation of a sustainable retirement village is well above the simple scoping of "design-it-sell-and-built-it". Typical hit-and-run developers should be held accountable by enlightened retirees buying into retirement villages.

Considering the above, what literature bears relevance? The following has been sighted in this regard:

- (a) Guide to retirement places by McAlpine (2006). This guide deals with the physical location and provides short notes regarding “retirement places”. Although it summarizes some elements, it makes no contribution to the creation of knowledge regarding sustainability.
- (b) Retire right by Cameron (2004). This publication deals with many elements of personal and financial concerns of retirees. Very little attention beyond financial advice is given to ensure that retirees find themselves residing in sustainable retirement villages. Valuable warnings are however provided regarding investment risks, resale, levies, poor management, financial concerns, healthcare and other support. A cautionary note is sounded by Cameron (2004:272): “The retirement village industry has not had a very satisfactory history in South Africa.”
- (c) The all pervasive long-term affordability crisis that has to be addressed head-on is demonstrated by the following abstract from an article on the Human Action website by J Galt (November 2009): Rand has lost 90% of its purchasing power since 1991. Diagramme 1.1 clearly demonstrates this disastrous phenomenon.

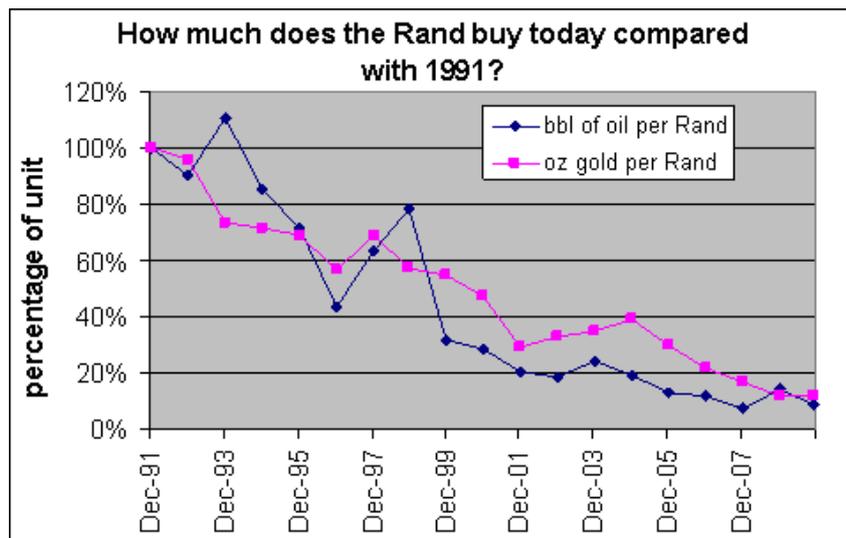


Diagramme 1.1 How much does the Rand buy today compared with 1991?
(Human Action website, 2009)

- (d) The 2-monthly journal, which is endorsed by two noteworthy organisations for older persons namely GreyPower and the South African Confederation of Seniors Organisations respectively, makes important contributions towards the sustainable retirement debate. The following article references bear relevance to this research:
- Malan and Labuschagne (2009:24-27) published an article, following a symposium, with the title: Meaningful aging – a multi-

disciplinary challenge. Important factors highlighted by them addresses issues such as the behaviour patterns of aging which is concerned with biological, psychological and social processes. Regarding social demographic issues like the erosion of traditional support structures, residential facilities, impoverishment, medical care, social and religious services. Reportedly already (2008) 7, 5% of the South African population is older than 66, expected to grow with 50% by 2021. Racial group poverty expressed as percentages of elder persons are alarming at 4% Whites; 19,5% Coloured; 6,6% Asian and very alarmingly at 56,2% Black.

- Van der Zel (2009:30-31) reports the following in an article titled: Creative and positive aging; that the factor that will influence longevity and health are:
 - Genes
 - Nutrition
 - Lifestyle
 - Environment
 - Socio-economic status
 - Attitude and change.
- Eckley (2009-2010:23-24) provides the following insights in an article: Care of older persons.
 - Demographics are changing rapidly:
 - 3,7 million South Africans are older than 60, and it will grow to over 6 million by 2030
 - The 80 years and older groups will grow from 550 000 to 1,2 million by 2030
 - Older blacks tend to migrate to cities, whites to rural areas. However, most people prefer to stay put where they are
 - Children as a social support system is degrading for a variety of reasons
 - Mortality data indicates that older persons tend to die as a result of life style diseases. Particular reference is made to inactivity, boredom, lack of “challenges” like working and not taking charge of managing their life style, health and aging.
 - There are presently about 480 independent retirement villages in South Africa that house approximately 89 000 people older than 50 years of age.
 - Eckley identifies the following success factors for aging:
 - Live and surround yourself with people that challenge you to still dream and work
 - Take care of your health
 - Take care of your sources of energy, your psychological and spiritual well being
 - Plan financially and live where the surroundings are conducive to your health
 - Ensure availability of security and healthcare

- Malan, Eckley and Bekker (2010:26-27) wrote an article: Frail-care centres – Achilles heel of many retirement villages with specific reference to frail-care centres and report the following:
 - Incredibly, developers of retirement villages often do not fulfil their undertaking to provide the “promised” frail-care centre
 - Only about two percent of residents (ten years ago about four percent) actually require the services of a frail-care centre
 - Frail-care centres are not economically viable below 25 fully occupied beds (absolute minimum), but should ideally have a critical mass of 40 beds
 - The cost of running frail-care centres is exorbitant and many residents simply cannot afford it if it is not subsidized.
 - Trustees of retirement villages are ill equipped to manage such centres
 - Some frail-care centres fall prey to obscure operators on contract basis
 - Home-based care should be available in retirement villages.

4. QUANTIFIED DATA PER GROUP

Primary data was collected in a structured fashion. The data produced reflects arithmetic means of the findings. The data is based on either a 5-point Likert Scale, or presented as percentages, or as yes or no responses.

Respondents were categorized into two groups. The first groups were easily identified, being the trustees of each retirement village. In some instances they preferred to provide a consensus based questionnaire, as some answers to questions should be the same, for example how many people reside in the village. In the case of individual responses the arithmetic mean was used.

The second group, representing the resident population, could not be selected by ordinary statistical methodology as some residents are too old or frail to take part, or may have only resided in the resort for a short period of time. It was therefore concluded that the most suitable and informed response from residents would be obtained from groups of 10 to 15 residents whom the trustees selected as persons with representative views regarding their retirement village. Practically this methodology worked well.

This research is on-going with surveys having been done in Pretoria and Bloemfontein, started with surveys in Johannesburg and due to be expanded to Cape Town. This report sights the first phase, being eight resorts in the East of Pretoria. Resident participants numbering 104 in the eight resorts represented 1 252 residents living in the eight resorts.

The residents' questionnaire has been loosely divided into different sections as indicated in the presentation in the next section.

The data presented is, as collected from the trustees, section 4.1 and from the residents, section 4.2. The data is the outcome obtained from the eight partaking resorts, reduced to a collective arithmetic mean, ranked in order of preference where applicable.

4.1 Research questionnaire and results for Trustees

Your home language	Afrikaans	80%
	English	20%
Gender	Male	51.4%
	Female	48.6%
Age	60-69	14.3%
	70-79	54.3%
	Older than 80	31.4%
Marital status	Married	54.4%
	Not married	8.6%
	Divorced	2.9%
	Widow/widower	37.1%

Please indicate if the following services at your village should in your view be provided by service providers on a contract basis, or by your own village employees.

Service	Contract basis	Own personnel
Security/gate control/guards	85.7%	14.3%
Catering services	79.4%	20.6%
Gardening services	55.6%	44.4%
Sub-acute care (where applicable)	76%	24%
Frail-care	66.7%	33.3%
Village management	8.8%	91.2%
Administrative work/collecting levies, etc	44.4%	55.6%
Cleaning services, buildings	25.7%	74.3%
Maintenance of buildings, etc	30.8%	69.2%
How many living units are there in your village?		127.2
How many living units in your estimation change hands every year in your retirement village?		6.09
How many residents are there in your village?		144.87
What is the average age of the residents in your village?		81.03
How long/number of years is your village in existence?		17.34
It is apparently becoming more difficult for residents in retirement villages to afford frail-care services. If you had the choice, when buying a housing unit in a new village, to pay about 5% more for your unit (which amount will be placed into a stabilisation fund by the developer), and to contribute about 8% of the re-selling price of your unit to the stated stabilisation fund (as a registered condition on the title deeds), specifically for future frail-care of residents, would you do so? Such contributions (which will be applicable to all living units in the village) should provide free or very affordable frail-care for those residents that may need it. The stabilisation fund will be under the control of the village management body/trustees.		
Yes		77.1%
No		22.9%
What percentage (%) of your village residents requires long		4.57

term care, typically bedridden? In other words, of all the residents, which % will according to your estimation, and based on your experience, ever require such long-term care. Figures that are often quoted range between 3 and 5%, but it has not been fully researched.

4.2 Research Questionnaire and results for Residents

Your home language	Afrikaans	84%
	English	13%
	German	3%
Gender	Male	39%
	Female	61%
Age	60-69	11%
	70-79	49%
	Older than 80	40%
Marital status	Married	51%
	Not married	5%
	Divorced	4%
	Widow/widower	40%
SECTION A: GENERAL HEALTH CARE (in order of priority)		
24-hour intercom emergency call system and support personnel		4.74
Frail-care		4.55
Sub-acute care (for illness conditions, post-operative care, etc)		4.22
Home care/nursing care in your own living unit as required		4.12
Special section for Alzheimer/dementia residents		3.91
Assisted living in main building (reside in your own room in the main complex, not necessary to be placed in frail-care section)		3.78
Availability of prescription medicines in the village (village pharmacy)		2.91
Special unit for disabled persons		2.90
SECTION B: EXTENDED HEALTH CARE (in order of priority)		
Wound care and bed sore nursing in the village		3.54
Disease control for chronic diseases, such as diabetes, in the village		3.14
Practicing foot carer/therapist in the village		2.95
Preventative medical information services and consultancy		2.95
Practicing physiotherapist in the village		2.93
Availability of a dietician services in the village		2.80
Practicing medical doctor at the village (surgery in the village)		2.79
Skeletal and bone care services in the village		2.64
Practicing labour therapist in the village		2.39
SECTION C: ADDITIONAL CONTEMPORARY FACILITIES AND SERVICES (in order of priority)		
Security systems/apparatus (such as electrical fencing) for the village as a whole		4.75
Security services (such as gate control and patrol services) for the village as a whole		4.75
Close proximity of shops		4.38
Dining room with daily meals		4.33

Own village mini-bus service	4.24
Close proximity of churches	4.13
Prepared meals available for delivery to living units on request	4.06
Library/reading room in main building	4.05
Hairdresser	3.89
Organised music concerts and other art activities	3.54
Central gardening area for general use	3.47
Home cleaning service	3.40
Central outdoor entertainment, barbeque and recreational facilities	3.24
Clothes washing and ironing service	3.09
Organised hobby and handcraft activities	3.01
Coin operated washing room	2.88
Manicure and pedicure services	2.85
Computer/Internet connection available in village for use of residents	2.77
Organised adult education programmes	2.76
Gymnasium with exercise equipment	2.68
Wellness Centre where services are rendered such as massages, spa, reflexology, cosmetic treatments, etc	2.55
Swimming pool, spa pool, general water therapy services	2.51
Tuck-shop	2.48
Continuous coffee/tea room services in main building	2.47
Anti-aging care, such as skin care, alternative dietary support, natural product prescription and use, herb medicines and treatment, etc	2.38
Central vegetable/herb garden for resident's participation and village use	2.20
Chiropractic services	2.14
Sauna/steam bath facilities	1.92
Ladies bar in main building	1.48

SECTION D: GENERAL INFORMATION (in order of priority)

Regardless of the type of unit that you presently occupy, which of the following would be your first preference regarding a living unit in a retirement village?

Town house	75%
Typical flat in a multi-storey building	15%
Hotel type complex with rooms	6%
Others	4%

Who is the owner of your present living unit?

Yourself	77%
Your children	6%
A trust	3%
Others	14%

Which legal form of ownership of a living unit in a retirement village is your first choice, regardless the form of your present unit?

Sectional title	83%
Share block	1%
Life right/Occupation right	14%
Others	2%

What is your preference regarding garaging for cars?

Lock-up garage	80%
Carport	18%
Open parking area	0%
No garaging or parking required	2%
<hr/>	
If you should contemplate to buy a unit in a retirement village again, would you be prepared to pay approximately 8% more for such a unit if it was designed to be energy efficient, with amongst others, solar water heating, emergency lighting during power outages, better quality window and floor tightness, floor, ceiling and wall insulation, etc?	
Yes	86%
No	14%
<hr/>	
It is apparently becoming more difficult for residents in retirement villages to afford frail-care services. If you had the choice, when buying a housing unit in a new village, to pay about 5% more for your unit (which amount will be placed into a stabilisation fund by the developer), and to contribute about 8% of the re-selling price of your unit to the stated stabilisation fund (as a registered condition on the title deeds), specifically for future frail-care of residents, would you be prepared to do so? Such contributions (which will be applicable to all the living units in the village) will ensure free, or very affordable, frail-care services for residents that may need it. The stabilisation fund will be under the control of the management body/trustees of the village.	
Yes	69%
No	31%
<hr/>	
If many of the above "extra" services referred to in Sections A, B and C (excluding care services) were available in your village, would you be financially able to afford it?	
Yes	47%
No	53%

5. DEMOCRACY IN DESIGN WORKSHOP

OBJECTIVE: To determine which aspects concerning the design and management of retirement villages function well, and which are insufficient.

Data was collected during a workshop with the chairpersons and managers of villages. The workshop was conducted in the format of agenda points, followed by the response of the participants.

The following aspects were evaluated, the results of which are available in a more comprehensive format than presented in this paper.

1. Functionality of living units:
 - Floor layout/floor plan
 - Bathrooms
 - Accessibility
 - Private gardens
 - Home security
2. Functionality of the following areas:
 - Offices
 - Dining room

- Lounges and halls
 - Kitchen
 - Garages/carports
 - Parking areas
 - Care facilities
 - Sub-acute facilities
 - Public areas and passages
 - Guest house/visitors' accommodation
3. Functionality of general services:
- Energy efficiency
 - Garden water/borehole
 - Premise perimeter security
 - Gate security
 - Catering
 - Intercom
 - Emergency call system
 - Gardens
 - Maintenance problems
 - Municipal services or the lack thereof
4. General management aspects:
- Personnel requirements
 - Office installation and equipment
 - Financial management
 - Long-term financial viability/sources of additional funds
 - Residents' long-term affordability
 - Property insurance
 - Possibilities regarding co-operative management services and facilities
5. Developers' legacy:
- Broken promises
 - Dysfunctional aspects
 - Financial aspects
 - Statements made with general consensus
 - Does practical, sustainable and affordable health care in private retirement villages exist?
 - Architectural conformity occurs in many retirement villages
 - Turn-around strategies for existing retirement villages with deficiencies

6. SUMMARY, CONCLUSIONS AND DIRECTIVES (RECOMMENDATIONS)

The research reported in this paper is on-going and further knowledge should ensue. Preliminary observations indicate that the problems experienced by the target group in this study (private not subsidised retirement villages) are similar in many respects to those observed in the developed world. The latter however find themselves in countries where governmental and other forms of support are well entrenched, contrary to South Africa where practically no such support exists. This particularly presents “new” retirees from the “baby boomer age” with new challenges regarding aging and sustainable care. The developed world is however not without problems regarding sustainability and affordability. Comparative studies in developed countries could therefore add value to this research.

In regard to the above, Hoffman (2009:16-17) reports that by 2030 half the population of Europe will be over the age of 50, by 2050 20% of the Asian/Pacific population will be over 60, China alone will have 300 million people over 60 and Sub-Sahara Africa 140 million over 60. The Oxford Institute of Ageing (University of Oxford) is actively studying global ageing demographics, also focussing on Africa. From there Hoffman (2009:17) states that: “With one of the highest Gini co-efficients of inequality in the world, South Africa is in a certain sense a micro-cosmos in which aging can be studied - the ageing world in one country”.

For practical reasons the results of this study may be condensed to the following perspectives:

- For now, there is no indication that viable alternatives to private retirement villages are on offer. In fact, the need for sustainable private retirement villages appears to be set to grow.
- Frail care and other forms of health care are top priorities for retirement village residents.
- Personal safety and security rank equally high in the stated requirements of residents.
- Other supporting services and general convenience aspects also rank high.
- There seems to be little testimony that a need exists for “extravagant” services in general.
- Although the researchers are of the opinion that a total wellness approach and provision of holistic wellness facilities and concepts are very important, there are few comparative elements in existing villages that could be evaluated and responded upon by residents. These elements which could be argued, represent the “new challenge” in creating a holistic environment that supports longevity, wellness and financial sustainability.
- Provision of practical and functional facility designs that cater for the needs of the aged are regarded as non-negotiable.
- Simplex/town house accommodation is strongly preferred, but may not be affordable.
- Other than in support of churches and welfare organisations, no sound reasons could be found for retirees to buy residences in life right villages, rather than in villages where they will be title holders. It simply

does not make sense to let the capital growth mainly accrue to the “developer”.

- There is strong support for energy and other resources efficiency.
- Residents are acutely aware of the affordability crisis that faces retirees and are strongly in favour of financial modelling that will promote long term financial sustainability for their villages.
- Although the first leg of this study has been conducted in what is regarded as an affluent area in South Africa, more than half of the residents, of which 49% is between 70 and 79 years old, and 40% older than 80 years, can afford more than the fixed village levy. Practically that means that if there is not a suitable intervention to provide support for what is perceived to be required and “nice to have” items, residents cannot afford it. This affordability crisis includes frail and many other forms of care and wellness which could be classified as essential.
- Although not quantified in this study, a logical conclusion that could be drawn is that a grading system against which the quality of retirement villages could be measured will support the creation of sustainable and functional villages in general.

There are obvious concerns internationally that the world’s ageing population could present a grave problem in future. However, there are also many sources that reports in parallel to this perceived eminent affordability crisis regarding the care required by retirees, that the reality is that many ageing people do not necessarily want to go the route of “traditional retirement”. There is enough testimony that staying active is healthy, reduces the risk of diseases such as Alzheimer’s, and assists in bridging the affordability crisis. Some countries are already increasing the qualifying age for receiving retirement benefits in line with higher life expectancies and national affordability. The advent of an ageing population automatically becoming a social burden could perhaps be overstated. If ageing people remain economically active, even at a reduced pace, the problem of an ageing population could be relieved in many ways. There are already data indicating that the percentage of elderly people requiring frail care in later life is decreasing rapidly, also indicating that the quality of life is improving in higher age groups. These observations is worthy of further research in order to test the general assumption that the higher life expectancy of people will automatically create serious problems. That may only be true if the ageing population also requires longer dedicated healthcare for longer periods than previous generations. Obviously the increase in numbers of elderly carry weight, but the exact impact with all factors attached to it requires more serious consideration and research than what is available at present.

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Attributes of Photovoltaic Energy Technology Perceptions of Ghanaian building industry Participants

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ABSTRACT

Purpose of this paper

This paper describes the conceptual framework used to evaluate the potential factors that may influence adoption of photovoltaics by individuals within the Ghanaian building industry.

Design/methodology/approach

The aim of the paper was carried out through a critical review of literature dealing with diffusion in general and within the construction industry. The review helped identify relevant concepts associated with the diffusion and adoption of innovations and the relationships between them as well as the factors to be evaluated.

Findings

The diffusion of innovation theory (Rogers, 2003) and a framework by Hartmann et al. (2006) together provide the majority of the relevant variables required for the empirical portion of the study and these include the perceived attributes of the innovation, the type of innovation decision,

communication channels, the nature of the social system and the extent of change agents promotion efforts.

Research Limitations and implications

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Diffusion literature is vast and contributions to it are from various disciplines hence framing a single study within the structure of its width and depth is impossible. The final choice of a conceptual framework was therefore limited to literature that related to the individual as a unit of analysis.

Practical implications

By knowing how and why innovations are adopted and diffused as well as related factors, it is possible to accelerate the technology adoption process through more effectively designed programs, demonstration projects, channels of distribution, marketing strategies, and policy incentives (Koebel 2004).

What is original/value of the paper?

This paper is part of a larger study that extends the diffusion of innovation theory by using it within a new context. The paper presents only the conceptual framework and not the findings of the subsequent empirical investigation. Although the findings presented in this paper are not original to the author, the value of the paper lies in providing a review of current literature and a conceptual framework based on which formal inquiries into photovoltaic adoption and diffusion in Ghana can be integrated.

KEYWORDS: Photovoltaic, innovation diffusion, adoption, Ghanaian building industry

1. INTRODUCTION

According to Alsema and Nieulaar (2000) “photovoltaic energy conversion is widely considered one of the promising renewable energy technologies which has the potential to contribute significantly to a sustainable energy supply and which may help to mitigate green house emissions.”

In Ghana, where there is a need to decrease demand on the national grid and also increase the renewable component of the nation’s energy mix, photovoltaics¹ seem like a plausible means of achieving both goals simultaneously especially by incorporating them in new buildings in urban areas.

Paradoxically literature, relating to Ghana and the world, shows that there is a significant difference in the actual levels of investment in photovoltaic energy technology and the possible levels of investment given the physical and technical potentials (Bawakyillenuo, 2007). This problem of adoption and use of photovoltaics has been attributed to a number of barriers, including misplaced incentives, distortionary fiscal and regulatory policies, unpriced cost such as air pollution, unpriced goods such as education, training and technological advances, and insufficient and imperfect information (Brown, 2001; Golove & Eto, 1996; Painuly &

¹ Photovoltaics are a type of solar technology that generates electricity using sunlight

Fenhann, 2002). Consequently the aim has been to identify these barriers and eliminate them in order to promote adoption.

Whereas this traditional approach has been to identify related barriers and eliminate them, an alternate approach to compliment the traditional approach is presented in this paper. This perspective seeks to understand the factors that influence individuals' adoption of photovoltaics by focusing on how the theoretical understanding of the diffusion of innovations can be used to evaluate the factors that influence photovoltaic adoption and diffusion in the Ghanaian building industry.

Formal inquiries into energy efficient and renewable energy technologies such as photovoltaics tend to isolate diffusion and adoption factors without integrating them into a broader theoretical framework except in a few cases (Bawakyillenuo, 2007). Investigations hence become difficult to compare owing to differences in concepts used to describe similar phenomena. Although photovoltaic adoption and diffusion has attracted widespread interest due to their environmental, national security and macroeconomic repercussions; they are essentially like other products and services which also face obstacles that hinder their adoption. As such they can be investigated using the vast array of concepts and theories; grouped under the umbrella of innovation diffusion; specially established to study how and why new products, practices and ideas spread.

2. Aim

This paper presents a conceptual framework that forms part of a larger inquiry evaluating the potential factors that may influence photovoltaic adoption in the Ghanaian building industry. The framework forms the basis of the study comprising the concepts specific to the issue being investigated as well as the relationships between the concepts.

In the study, literature relating to innovation diffusion in general and within the construction industry in particular was reviewed. The main issue of concern dealt with in literature was

What causes individuals to adopt innovations invented by others?

It is from the above literature that the theory that is used in this study is elicited. It is the classical diffusion theory as proposed by Rogers (2003).

It draws from a wide range of disciplines to provide a comprehensive structure for understanding adoption and diffusion. It has influenced many other adoption and diffusion theories, provides a majority of the relevant variables, and is one of the most widely cited of the diffusion theories. (Straub, 2009)

3. INNOVATION DIFFUSION

With the proliferation of a wide number and variety of new technologies required to deal with the complexity of problems currently faced by the world a lot of interest and research has been shown in the process a new

technology goes through from invention, diffusion and widespread commercialisation — the innovation process.

Introducing photovoltaic technology into buildings in Ghana involves the need to influence potential adopters, who are in this case the individual and organisations involved in the building process. Consequently an understanding of the innovative behaviour of these individuals and organisations is relevant so as to manage the innovation diffusion process adequately given the importance of innovation to organisational competitiveness and effectiveness (Panuwatwanich, 2008) as well as the importance of construction to national growth and development (Ahadzie 2007). The major concept that relates to the issue being investigated is diffusion.

3.1 The classical diffusion theory

Roger (2003) defines diffusion as the process by which an innovation (an idea, practice or object perceived as new by an individual or adoption unit) is communicated through certain channels over time amongst the members of a social system. The speed of diffusion is measured as the number of members of a social system that adopt an innovation within a given time period and so diffusion can be considered as a series of adoptions (Hartmann *et al.*, 2006).

The adoption of an innovation involves a decision process that is made up of the steps that potential adopters go through in making a decision on whether to adopt or reject an innovation: an individual or unit of adoption passes from the first knowledge of an innovation to a decision to adopt or reject, to implementation of the new idea and the confirmation of the decision.

This process is made up of five sequential steps: knowledge — exposure to the innovation and an understanding of how it works, persuasion — this occurs when a favourable or unfavourable attitude is formed toward the innovation, decision — this occurs when an individual or adoption unit engages in activities that result in the decision to adopt or reject an innovation, implementation — this occurs when an innovation with a favourable evaluation is actually put to use and confirmation — this occurs when the individual or innovation unit seek to reinforce the decision made or reverse the decision if exposed to conflicting messages about the innovation (Rogers, 2003).

Various factors including perceived attributes of innovation, the type of innovation decision, communication channels, nature of the social system and the extent of change agents' promotion efforts have an effect on the process and outcome of the innovation decision process. (Figure 1.1) The factors that affect this process vary, depending on the industry and decision makers involved and hence the variables have to be investigated for a particular sector, innovator or innovation (Koebel *et al.*, 2004). In this study the focus is on the photovoltaic technology (the innovation) within the building industry in Ghana.

3.2 Conceptual framework

In addition to Roger's theory, the theoretical considerations in this study depart from the work of Hartman *et al.* (2006) in which a conceptual framework of the innovation decision process of construction clients is presented. The work of Hartmann *et al.* (2006) was informed by Roger's (1995) work. In the framework Hartman *et al.* (2006) argues that the adoption behaviour of clients may be traced to the links between context, communication, and perception. In other words the appropriate information sources or how innovation attributes are perceived depend on a range of contextual factors: the environment, organisation and technology. The three concepts (communication, perception and context) and their relationship to the adoption decision are explained below

Communication channels

Seeking / knowledge and processing information / persuasion about an innovation represent the first steps of the adoption process. In fact, Rogers (2003) describes the innovation-decision process as an information seeking and processing activity in which an individual seeks information in order to decrease the uncertainty about the innovation. The quality of these activities is essential to adoption and is dependent on the communication characteristics within the social system of which the adoption unit is a part. The adoption and implementation of an innovation is only possible if potential adopters are aware of its existence as well as its values and benefits. The source, mode and quality of communication therefore determine the adopter's knowledge of the innovation, how the adoption unit perceives the attributes of the innovation and consequently the evaluation of the innovation and the propensity to its adoption.

In construction, communication channels may exist communication between stakeholders such as clients, suppliers or business partners and other project participants, government agencies and research institutions in addition to personal sources such as friends or near peers. Written communication such as print media, letters and emails and oral communication via telephone or face-to-face comprise the modes of communication. Interpersonal contacts and word-of-mouth communication have a greater effect on the development of perceptions whilst mass media and written communication aid the creation of awareness (Rogers, 2003).

Perception of innovation attributes

Innovation attributes refer to specific characteristics associated with an innovation and are measured as perceived by the potential adopter of an innovation. Although there are other factors that affect innovation adoption too, innovation attributes have been shown to explain significant variance (49-87%) in adoption decisions (Ostlund, 1974; Dearing, 2007; Rogers 2003).

Five standard attributes have been defined by Rogers (2003) and include:

- The relative advantage of the innovation;

- Its compatibility with the potential adopters' current way of doing things and with social norms;
- The complexity of the innovation;
- Trialability, the ease with which the innovation can be tested by potential adopter, and
- Observability, the ease with which the innovation can be evaluated after trial.

Of the five attributes, relative advantage, compatibility, and complexity have been most strongly associated with adoption decisions (Dearing, 2007).

The context of innovation adoption

The adoption and diffusion processes occur within a specific social context or system and hence are influenced by contextual factors that according to Hartman *et al.* (2006) can be assigned to three context levels: the environment, the organisation and the technology.

At the environmental level the project-based nature of construction affects adoption behaviour and the adoption process is always connected to the construction process. For example, the constraints of the project such as time and budget affect the adoption process, and characteristics of the constructed facilities are expected to affect the perception of innovation attributes.

On the organisational level the experience and competence of the adopter are influential factors in that where an adopter is experienced and has high competence an innovation is more likely to seem less complex. This is because the adopter is better able to understand the technology. The innovativeness of the adopter or the willingness to innovate also comes into play at the organisational level in that adopters that show an innovation-oriented culture and strategy are more likely to come to a favourable innovation decision. The organisational structure, whether hierarchical or project-based, also plays a role in innovative behaviour (Taylor & Levitt, 2005).

On the technological level, the degree of newness has considerable effect on the perceived innovation attributes and the information sources used for communication. With an increased degree of newness prior usage of the innovation is important since there is observability and hence a higher probability of implementation in future projects.

Roger's (2003) theory and Hartmann *et al.*'s (2006) framework as outlined above are used as a guide in the investigative process to identify and evaluate the potential factors that may influence innovation adoption in the Ghanaian building industry.

4. DISCUSSION AND CONCLUSION

Diffusion literature is vast and contributions to it are from various disciplines; hence framing a single study within the structure of its width and depth is impossible. The final choice of a conceptual framework was

therefore limited to literature that related to the individual as a unit of analysis and at the end of the review, two major questions which are tackled by the subsequent empirical portion of the study emerged:

- What are the significant factors that influence a decision to adopt an innovation by individuals within the Ghana building industry?
- What are the perceptions of individuals within the Ghanaian building industry about the attributes of photovoltaic energy technology?

By understanding the factors that are important to decision-making among individuals, the adoption of photovoltaics can be enhanced by improving the significant factors. Understanding the relative importance of the varied factors will furthermore help determine how priorities should be set and resources allocated when improving these factors especially where resources are limited. Also, understanding the perceptions that individuals have about photovoltaics will help appreciate their adoption behaviour and where perceptions are wrong or can be improved, efforts can be made in this regard.

4.1 Contribution

Experiences with photovoltaics and other related technologies have revealed the need for rigorous systematic investigations to inform the policy-making process required to positively influence adoption and diffusion. Consequently, outlining a conceptual framework that sets out the theories, beliefs and prior research findings is key to guiding and informing the investigations and understanding the issues being studied.

Supporting an empirical inquiry with a conceptual framework as presented above provides a majority of the factors to be evaluated. These include the perceived attributes of the innovation, the type of innovation decision, communication channels, the nature of the social system and the extent of change agents' promotion efforts.

Also it makes it easier to identify new information that may extend the boundaries of the selected framework. Furthermore a framework may also present the methodological options available for the study and provides a reference point around which the discussion of the results and findings are centred.

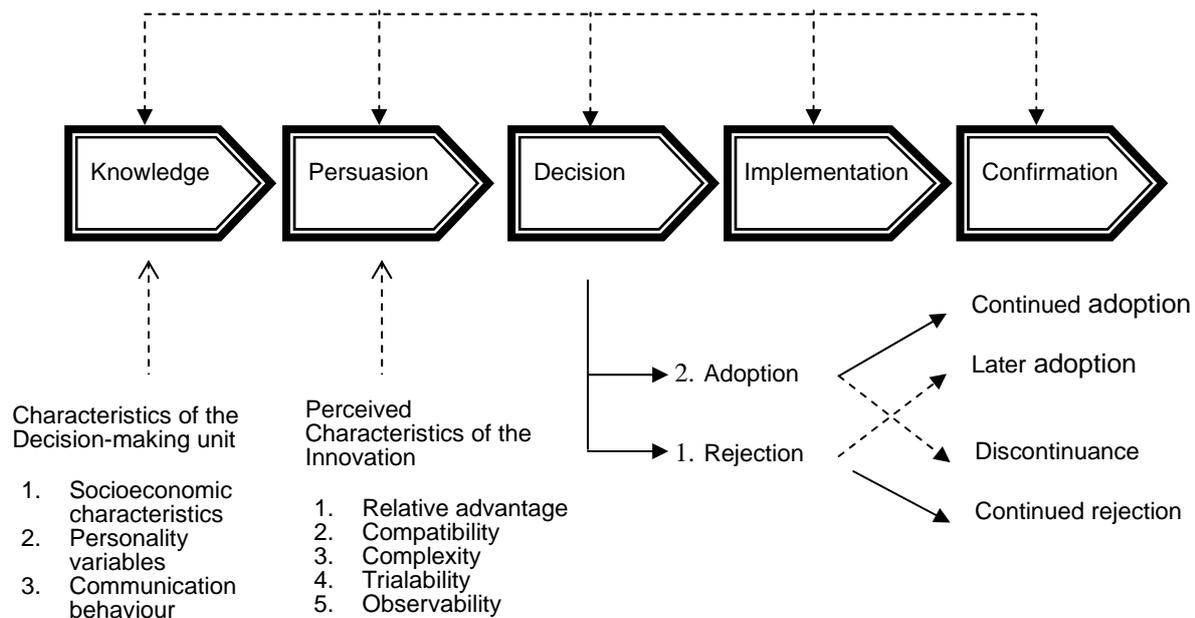
5. CONCLUSION

By knowing how and why innovations are adopted and diffused; related factors, it is possible to accelerate the technology adoption process through more effectively designed programs, demonstration projects, channels of distribution, marketing strategies, and policy incentives (Koebel, 2004). This knowledge has however not been effectively exploited in the Ghanaian photovoltaic adoption process. The use of the theory of diffusion of innovation in investigating the adoption of photovoltaics is limited and those that pertain to the Ghanaian building industry in particular is absent.

This review therefore provides the justification for a larger study which extends the use of the theory applying it to a new context. In addition the study extends the focus of Hartmann *et al.* (2006) to include electrical engineers and architects in addition to building clients. This is based on the argument that the decisions pertaining to the design and construction of building projects is a collective process that includes other participants apart from the client and although the client is the initiator of the project, technical decisions are largely informed by the other project participants especially where the client is inexperienced. Therefore, investigations should include the adoption behaviour of other building participants in addition to the client's.

Ultimately, the results of the larger study are expected to guide policy formulation on photovoltaics and innovations that relate to the building industry in Ghana and inform the management of the diffusion process.

Figure 1.1 A Model of the Five stages in the Innovation-Decision Process indicating the factors that influence the process (adapted from Rogers, 2003)



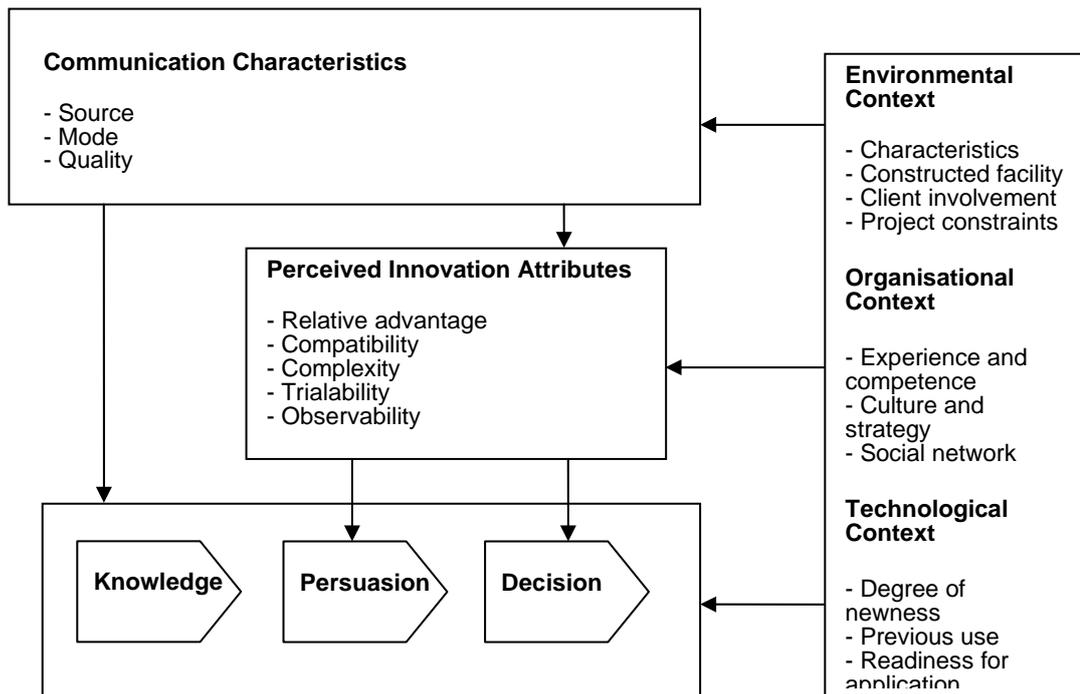


Figure 1.2 Conceptual Framework of innovation adoption process of construction clients adapted from Hartmann *et al.* 2006

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The challenge of informal settlement statistics and impact on policy and planning in South Africa

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ABSTRACT

Purpose: The principal argument in this research is based on the fact that statistical data are very necessary for the formulation of policy and planning to target informal settlement challenge. Quantitative data is increasing being used for planning issues such as access to housing, health, socio-economic activities and infrastructural provision.

Problem of investigation: Research has shown that Informal settlement varies greatly in their sizes and by providing information on how many settlements are informal and formal, how many men and women are residing in informal settlements, what is the total number of infrastructures and socio-economic needs such as access to jobs, clinics, education facilities and open space, planners will be guided and equipped to adjust or improve policies towards these vulnerable group of urban residents. The question that will be answered is: To what extent can the collation of quantitative data on informal settlement assist planners and policy makers in the policy making process in relation to informal settlements in South Africa?

Design/Methodology/Approach: This investigation was based on primary and secondary data with great emphasis on the analysis of Census 1996 and 2001 as well as Community Survey of 2009. The study used Geographic Information Systems data. These findings were contextualise in Johannesburg as a case study because this happens to be one of the municipalities with high rate of urbanization and attendant housing shortages. The sporadic increase in the number of households living in Informal Settlement cannot continue to be neglected or unabated without accurate data for monitoring and evaluation.

Findings: This investigation found out that data on informal settlement can help to mitigate service delivery protests and resistance to relocation that is being witnessed.

Value and Originality: The study identified gaps in informal settlement policies resulting from government neglect of the role of quantitative data in addressing the phenomenon as compared to other developing countries.

Conclusion: There is need for public policy makers and planners to collate data on informal settlement for monitoring, evaluation and effective service delivery and provision

Key words: Informal settlement, quantitative data, population, policy and Johannesburg.

1. INTRODUCTION

“Give me statistics and I will give you everything”
Napoleon Bonaparte 1 (1769-1821), Seligman (1933)

The principal argument in this research is based on the context that statistical data are very necessary for formulating policy dealing with informal settlements. Statistical data, which will be used interchangeable with quantitative data, are prime source of justification, which shows that phenomena can be substantiated. It is of immediate and practical utility (Hearth and Downie, 1965). Often research is conducted on limited scale, not to test a theory, but to uncover information vital to help in solving a practical problem. The usefulness in solving problem has made the application of statistical methods very vital in all fields of learning. Banerjee (1999) argues that appropriate settlement policy depends on the validity and reliability of the data provided. The meaning of this is that the more reliable and valid the data, the better it can assist in policy formulation, hence valid and reliable quantitative data plays a cardinal role in this regard.

Proper planning and organization of things in space cannot be effectively carried out without relevant data and information. Quantitative data is increasingly being used for planning issues such as housing, health, socio-economic activities and infrastructural provision. These key services that keep the urban environment functional cannot play the expected roles with regard to development if data availability is lacking (SACN, 2004). By providing information on how many settlements are informal and formal, how many men and women are residing in informal settlement, what is the total number of infrastructure and the socio-economic needs such as access to jobs, clinics, education facilities and open spaces, planners will be more equipped to adjust or improve their policies towards these vulnerable group of urban residents. Recent research has shown that there is limited scope in understanding the relevance of quantitative data in relation to informal settlement in South Africa (Siliga, 2003). This is because government at times collects statistical data and frequently uses it to satisfy its political priorities in terms of satisfying election needs and for demarcation of territorial boundaries. Little consideration is given to socio-economic issues and the spatial distribution of informal settlements in relation to these data gathered. This compels concern civil societies and planners to argue with regulating authorities on the need to balance their

various input in the policy-making process with statistical data concerning these issues. There is also conflicting interpretation as to the definition of informal settlement as compared to “informal dwelling” backyard shacks” as depicted in both 1996 and 2001 census in South Africa (SSA, 2001). The 1996 census collapses informal dwellings on serviced sites with those in “squatter” settlements into one single category (Huchzermeyer, 2004).

This combine classification portrays an unclear terminology, which permeates the South African literature on housing (ibid). The justification here is that a good understanding of this scenario about appropriate interpretation of informal settlement and relevance of quantitative data will serve as yardstick for any anticipated development in terms of upgrading and improvement of infrastructures. Data collected on informal settlement will also assist the ongoing monitoring and evaluation interventions to support the programme. Hence, it is very crucial at this stage of South Africa’s democracy to be aware of the significance of quantitative data in policy formulation and implementation concerning informal settlements, as this will be of great benefit to the vulnerable low-income group residing here and the government. This research should also be understood against the backdrop of the call by the former Minister of Housing Lindiwe Sisulu reiterate that:

“I am to provide people with a home that they can be proud of, instead of just dumping them in a township with no amenities” (Engineering News, 2004). The emphasis being laid here is that “all informal settlements will be rehabilitated” and that plans are underway to identify owners and register all shacks as this would go a long way towards ensuring viable human settlement rather than just townships. This registration is nothing more than the search for relevant quantitative data, which will guide the formalization processes. The incessant outbreak of fire being recorded in almost all informal settlements in recent times endangering both life and properties will be mitigated. These incidents are due to excessive compaction of buildings and lack of access routes for fire rescue officers in time of emergency. Hence, the compilation of data on informal settlement is imperative as it will address the issue of the population, where the settlement is located, user and number of infrastructure thereby assisting planners and policy makers in monitoring, evaluating and forecasting of the type of amenities to be provided. The study contributes to knowledge on the relevance of using statistics on informal settlement policies and planning. It unpack effort to mitigate informal settlement phenomenon as it bears a lot on urban poverty, exclusion and marginalization.

Research problem and its settings

In an attempt to explore the above stated objectives it is imperative to formulate questions that will be addressed by this research. This includes: To what extent can the collation of quantitative data on informal settlement assist planners and policy-makers in the policy-making process with relevance to informal settlements in South Africa? What lesson can be derived by reviewing the validity of census 1996 and 2001 on issues relating to informal settlement in South Africa? Significantly, answering the above questions will shed some light on understanding the significance of statistical data on informal settlements and policy formulation to address the issue. One of the gaps that has been found in informal settlement upgrading that informed this research investigation, especially in the

context of South Africa is lack of reliable quantitative data to assist in implementing sustainable upgrading projects.

Aims and objective of the study

This investigation portrays the relevance of Census 1996 and 2001 in the classification of informal settlement in South Africa. This study will widen the knowledge and expertise on the use of quantitative data on issues relating to informal settlement policies interventions. It will be of great relevance to policy-makers, planners, statisticians and other related disciplines on issues relating to urban poverty, social exclusion and marginalisation which impact on the economy as a whole. The study identified gaps in informal settlement policies resulting from government neglect of the role of quantitative data in addressing the phenomenon as compared to other developing countries.

Research Methodology

The research looked at the use of statistical data in informal settlement policies in South Africa. The most appropriate method for this research will be the case study. Case study is a scientific method of investigation that will assist to contextualise South Africa experience in the use and application of quantitative data on informal settlement policies in view of what is obtainable in Brazil, India and Kenya. Case study research is preferred in this context because this investigation deals with “how” and “when” question (Yin, 1994). This research method assisted in this investigation because the focus is on a contemporary phenomenon with some real life context (ibid). It is basically explanatory research with some advantages and disadvantages that were dealt with in later chapter. The census data of 1996, 2001 and the Community Survey of 2007 will also form import resource to the research.

Theoretical framework and Literature Review

The historical development of statistical ideas and techniques as regards their practical application has been relatively little studied (Owen, 1976). Thus, Stigler, (1973) cited in Owen, (1976) has noted that in the eleventh century the Arabic doctor Avicenna laid down the seven rules of experimentation of human subjects, including a recommendation for replication and the use of controls and a warning of confounding variables. The term ‘data’ often used to denote statistical material derived from the Latin work, which is, literally translated as “giving things” (Irvine, 1979). The term statistics is derived from Latin word root ‘status’, which signifies a state in the political sense has a long history. The act of policy formulation and planning using statistical data dates back to the existence of man on earth during pre-historical times. The first exploit of the importance of quantitative data is recorded in the work of the lord God to Noah before 2000 B.C. “Take with you seven pairs of each kind of ritually clean animal, but only one pair of each kind of unclean animal. Take also seven pairs of each kind of bird. Do this so that every kind of animal and bird will be kept alive to reproduce again on the earth” (Good News Bible, 177:11). Census is an exercise concerned with the counting of the total number of people living in any given geographical territory with defined boundaries. It is a

branch of advanced mathematics called statistics. Shaw and Miles (1979) noted the earliest census carried out in Egypt around 3000 B.C to determine the resources for the construction of Great Pyramids. The essence of this exercise was to inform

Policy concerning the necessary resources for this project. In England, the three most important attempts at enumeration of population all had a physical purpose, namely: the Doomsday Survey of 1086, the Poll Tax of 1377 and the Duty on Marriages, Burials and Baptisms of 1695 (Ibid). As far as 1793 population statistics were available in South Africa the first reliable census was taken in 1865 (Wood, 1979). This was followed by the census of 1904, which marked the Union of South Africa, and ever since 1911 the census has been a regular exercise in South Africa. Some of the early problems encountered in the continent were due to high level of illiteracy and lack of trained manpower to carry out the exercise. Some of the early recorded census are Egypt 3000 B.C; Tanganyika, 1957, Tanzania, 1957 and 1978; Uganda, 1959 and 1969; Kenya 1962 and 1969; and Nigeria 1962 and 1973 (Ibid). Bureacracy, which is based on rationalizing organization for optimum efficiency, is found to make extensive use of recorded information and statistics (Weber, 1964). This information assist bureaucrats in both policy formulation and implementations. Forester (1989) questions that in a World of poor information and limited time to work on problems how would careful analysis of alternatives be possible? President Yoweri Museveni of Uganda once noted that without adequate information planning is useless (Statistics South Africa, 2004). This is based on the progress, which the country recorded in the treatment of HIV/Aids. Information is very important in this context because the progresses was brought about by proper record of the total number of infected people in every community and in every hospital as people were open to talk about their status, this assisted in devising appropriate comprehensive intervention strategies to mitigate the disease. In his comment on the relevance and need for Census in the area of socio-economic needs, the Director General of Statistics South Africa, Pali Lehohla stated that democracy will not succeed where statistical information is not available (SSA, 2004). This view was equally supported by the former Minister of Finance Republic of South Africa, Trevor Manuel, who concluded that we only know who are the poor, where they are and how they live, how to plan for them if we have data concerning them by populations. In his view, if 'one cannot measure it, one cannot manage it' (SSA, 2004). Information based on both local and national survey is very important as it makes it possible to formulate and implement realistic policies on housing standards, costs, re-development, re-location and forecasting of future trends (UNDESA, 1976). The provision of socio-economic needs such as housing, health and education can be difficult to provide not only because of lack of finance but due to limited data (Siliga, 2003).

Problem of informal settlement definition and general characteristics

Definition of an informal settlement varies from country to country and depends on a variety of defining parameters (Siliga, 2003). The definition of informal settlement is very important because it gives insight and understanding on the concept, which will be useful in view of the role of quantitative data for policy making process concerning it. According to

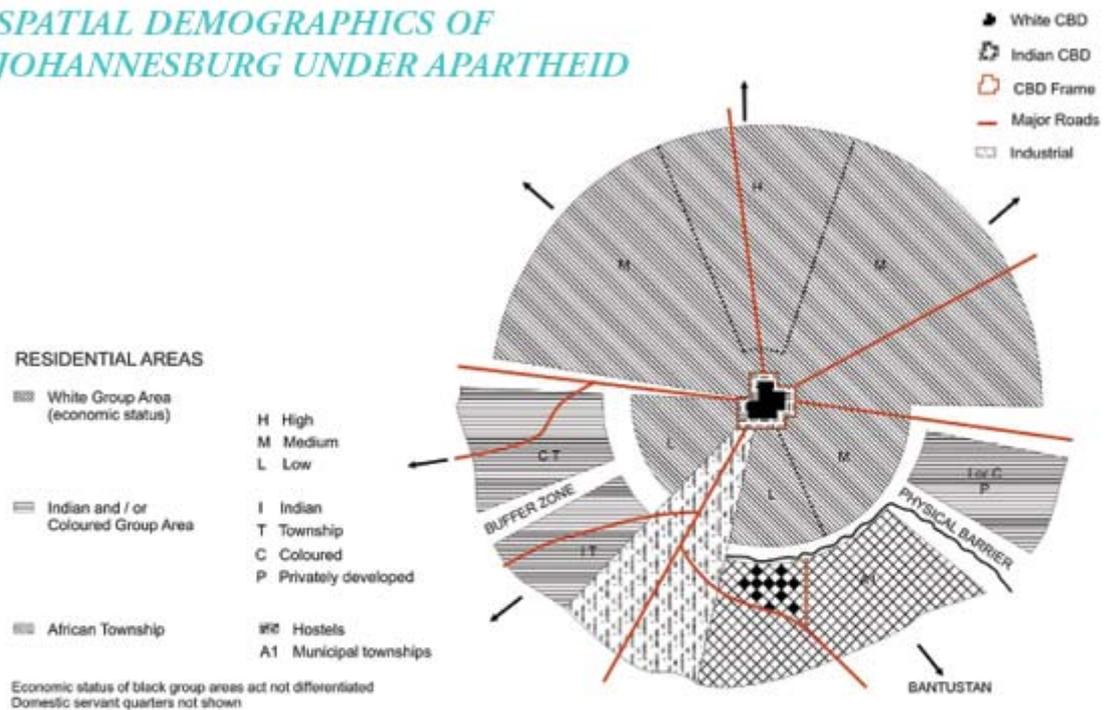
Srinivas (1991 cited in Onatu, 2004:45) informal settlement is defined as residential area in an urban locality inhabited by the very poor who have no access to tenure right and are forced to “squat” on vacant land either private or public. Huchzermeyer and Abbott (1999) defined informal settlement as urban low-income settlements that come about through unofficial occupation of land. This implies no legal right to the land. Not only is legality difficult to define, but also many unplanned settlements mix legal and illegal characteristics (UNCHS, 1982 cited in Kasarda and Pannell, 1993:84). Informal settlements are noted to be lacking in basic municipal services such as water, sanitation, solid waste collection, electricity, roads and social services. Informal settlement is also defined as

settlement which may present different forms of informality in relation to urban development (Huchzermeyer, 2004). Angel (2000) defined it as settlement that developed outside of the law through invasion, through illegal subdivision of land without proper permission, and through illegal sale or cession of land to which the vendors have no alienable rights. They are usually low-income areas and are commonly referred to by a wide variety of names, such as: ranchos in Caracas; callampas (and more recently campamentos) in Chile; favelas in Rio de Janeiro; barriadas (more recently pue blos juvenes) in Lima; villas misarias in Buenos Aires; colonias proletarias in Mexico – city; barong-barons in Manila, kwetlas in Rangoon; gacekondou in Isthambul, and bidonville in French speaking countries and mukhukhu in South Africa. Informal settlements according to Harrison (1992) represent an inseparable reality.

The Study Area

Johannesburg is the largest and most populous city in South Africa, with nearly 3.9 million population in 2007 (Community Survey, 2007). It is the provincial capital of Gauteng, the wealthiest province in South Africa, having the largest economy of any metropolitan region in Sub-Saharan Africa. Johannesburg is the source of a large-scale gold and diamond trade, due to its location on the mineral-rich Witwatersrand range of hills. Johannesburg is a divided city: the poor mostly live in the southern suburbs or on the peripheries of the far north, and the middle class live largely in the suburbs of the central and north. Around 20% of the city lives in abject poverty in informal settlements that lack proper roads, electricity, or any other kind of direct municipal service. Another 40% live in inadequate housing with insufficient municipal housing.

SPATIAL DEMOGRAPHICS OF JOHANNESBURG UNDER APARTHEID



Reproduced by permission from R. J. Davies, "The Spatial Formation of the South African City," *GeoJournal* Suppl. no. 2 (1981): 59-72, reprinted in A. J. Christopher, *The Atlas of Apartheid* (London: Routledge, 1994), 107, fig. 4.2.

Figure 1 Spatial Demography of settlement in Johannesburg

Johannesburg is one of the world's most cosmopolitan cities. The gold rush of the late nineteenth century drew people from all the ethnic groups of the sub-continent, as well as Europe, American and Australians. As the city grew, traders and entrepreneurs flocked in from India, China, Japan and East, West and Central Africa to the city to seek a better life (Moshia & Cavric, 2006). It was declared a permanent settlement in 1896 on the back of the discovery of gold in 1886 and was declared a city in 1928 (Johannesburg City Council, 2008). Today, Johannesburg is the country's premier industrial city and centre of finance and commercial activities. According to Community Survey 2007, City of Johannesburg recorded the second highest population increase with 20.6% after Midvaal local

municipality with 29.1%. This is due to high level of in-migration to the city from all other parts of South Africa in search of jobs and other livelihood means. The resultant effect is pressure on housing, social infrastructures and urban sprawl as people has to seek living accommodation under precarious circumstance resulting in informal settlement, land evasion and illegal occupation of both public and private land in and outside the city. About 180 informal settlements, comprising 200,000 households in and around Johannesburg have been identified (Draft IDP (2011/2012)).

Informal Settlement in South Africa: Characteristics and Statistics

Informal settlements in South Africa constitute both rural and urban informal settlements. These settlements must be seen as manifestation of broader social, economic and political process that are beyond the control and choice of the individual households (Huchzermeyer, et al, 2004). Informal settlement remains eyesores across major cities in South Africa. They constitute non-conventional housing built without complying with legal building procedures. These settlements are usually built at the edge of cities where land is cheap and neglected (Victor, 2009). These informal settlements are often better located than the housing development to which the government seeks to relocate them. The urban poor usually use salvage materials like wood, tins, corrugated iron and others to build these settlements. Others comprises of traditional materials such as mud brick, a compact earth blocks, building made of scaps, cardboards or plastic sheets (Kasarda and Parnell, 1993). It is very difficult to obtain a reliable figure of informal settlement backlog in South Africa. Statistics South Africa in Census (2001) enumeration designated an area as informal settlement by using one category of definition and classification for informal dwelling/shack NOT in backyard. This definition collapses shacks on service sites with shacks on unauthorized informal settlement (SSA, 2003). The Census enumeration (2001) distinguishes households based on three dwelling types formal, informal and traditional.

Formal dwelling comprises of, house or brick structure on a separate stand or yard

Informal dwelling comprises, shacks in backyard and NOT in backyard. This includes makeshift structure not erected according to approved architectural plan.

Traditional dwelling are a hut and structure made of traditional materials.

The above classification of Census 2001 is considered to be too ambitious because the collapsing of shacks on services sites and authorized informal settlements is out of context (Huchzermeyer, 2001). In the same vein Statistics South Africa in 2007 Community Survey claims that in 2007 there were about 1.2 million households living in informal settlement in South Africa. At another extreme Statistics South Africa argues that families living in informal settlements decreased from 16.4% in 2001 to 14.4%.

Meanwhile, 3 out of 9

of South Africa's provinces have higher figures of households living in informal settlements. For example, Free State has 18.4%, Gauteng 22.7% and North West 23.8% while Limpopo has 5.6%, Eastern Cape 8% and KwaZulu-Natal 8,6% recorded the lowest percentage of households living in informal dwellings. By contrast, estimates of the number of people

housed inadequately in South Africa are possibly higher (i.e above 1.5 million) than the Statistics South Africa estimation (Misselhorn, 2008 cited in Victor, 2009). Misselhorn remarks that figures of informal settlements are always used as the foundation for counting, and not the number of sub-families, which might live in a single dwelling. Stats S A (2007) guessed that there were about 65113 families in informal settlements in Cape Town in 2004 but, the City of Cape Town disputed that there were about 94972 families (Misselhorn, 2008 cited in Victor, 2009). See Table below.

Table 1: Total population by Province-Censuses 1996, 2001, and Community Survey 2007.

Provinces	Census 1996	Census 2001	% Change	CS 2007	% Change
Eastern Cape	6 147 244	6 278 651	2,1	6 527 747	4,0
Free State	2 633 504	2 706 775	2,8	2 773 059	2,4
Gauteng	7 624 893	9 178 873	20,4	10 451 713	13,9
KwaZulu-Natal	8 572 302	9 584 129	11,8	10 259 230	7,0
Limpopo	4 576 133	4 995 534	9,2	5 238 286	4,9
Mpumalanga	3 124 203	3 365 885	7,7	3 643 435	8,2
Northern Cape	1 011 864	991 919	-2,0	1 058 060	6,7
North West	2 936 554	3 193 676	8,8	3 271 948	2,5
Western Cape	3 956 875	4 524 335	14,3	5 278 585	16,7
South Africa	40 583 573	44 819 778	10,4	48 502 063	8,2

Source: Community Survey, 2007:6

The census results showed that the population of South Africa increased from 40,5 million in 1996 to 44,8 million in 2001. The Community Survey has returned an estimated population of 48,5 million, showing an overall increase of 8,2% since 2001.

The above figures are based on the new boundaries.

The largest percentage/rate of increase in population between 2001 and 2007 was in Western Cape with 16,7%, followed by Gauteng with 13,9%.

Eastern Cape, Free State and North West experienced an increase of less than 5%.

Post Enumerations Survey and Reliability of Informal Settlement data

Post Enumeration Survey (PES) is undertaken to determine the degree of undercount or over count in a population census, and to evaluate the quality of data collected during the census (Statistics South Africa, 1996). This also impacts on informal settlements as it helps to indicate whether the data on households living under the condition of informality are accurate and correct. In 1996 this exercise was undertaken immediately after the census, around November and December. The questionnaire used for the PES was a much shorter version of the census questionnaire. It includes question on age, gender, marital status, population group, home language and level of education (SSA, 1996). Respondents were also asked whether or not each individual in a particular household had been counted during the census and if so whether they were counted in that household. The aim of this is to crosscheck back to achieve more reliable and uniform data from the enumeration instead of sole reliance on the first round of the census. The result of the PES is matched with the census initial figure to help to determine the extent of the validity. According to the findings the matching of the results was very straightforward in areas with formal address as compared to difficulties in areas without precise address as witnessed in most informal settlements.

Table 2. Adjusted population figures by provinces as measure of reliability.

Category	Estimate	Lower	Upper
Provinces			
Eastern Cape	6,436,763	6,286,402	6,587,125
Free State	2,706,775	2,665,303	2,748,247
Gauteng	8,837,178	8,520,018	9,154,338
KwaZulu-Natal	9,426,017	9,030,906	9,821,128
Limpopo	5,273,642	5,244,376	5,302,907
Mpumalanga	3,122,990	3,081,917	3,164,064
Northern Cape	822,727	812,071	833,384
North West	3,669,349	3,608,191	3,730,507
Western Cape	4,524,335	4,439,010	4,609,601

Source: Statistics South Africa 2001. In the above table KwaZulu Natal has the highest population in South Africa followed by Gauteng as well as Eastern Cape.

Table 3: Informal Settlement in 70 selected Municipalities in South Africa

Province	Municipality Code	Count of Informal Settlement Polygons
Eastern Cape	EC121	378
Free State	FS172	208
Gauteng	GT02B1	625
KwaZulu Natal	KZN225	647
Limpopo	LIM362	135
Mpumalanga	MP303	227
Northern Cape	NC091	28
North West	NW373	179
Western Cape	WC023	201

Source: Informal Settlement Study Atlas 2009/10; Department of Human Settlement South Africa.

In the above table it can be seen that KwaZulu Natal has the highest number of Informal Settlement and this followed by Gauteng and Eastern Cape. This statistics has impact on the Housing subsidy allocation to the various Provinces, especially with the nature of Topography in KwaZulu Natal it attracts huge amount of revenue for bulk infrastructure for low-income housing and informal settlement upgrade.

2. CONCLUSION

This research raised a number of issues on the application of quantitative data on informal settlement as it will be relevance to policy makers and planners as well as the general built environment professionals in South Africa. The study by analyzing the Census 1996, 2001 and Community Survey of 2007 shows the importance of using quantitative data in informal settlement programme. The struggle daily lives of informal settlement and the typical challenges they face due to peculiar nature of the environment they are living can be improved if we know how many they are and their composition as well as need analysis. The government challenge for an informal settlement policy is to build and ensure inclusive relations between the local state and the organized structures of the informal settlement residents, that is, the civil society in all issues, especially policy-making mechanism. For this to be effective there is need to know the reliable number of residents in informal settlement and this has remain a gap in South African Human Settlement policy. The collapse of shacks on service site with informal dwelling described as one without approved architectural plan is a very ambiguous interpretation by the Census of 1996 and 2001.

Without equipping themselves with adequate data and statistical information, can both parties be able to make meaningful input into policy-making process concerning informal settlement?

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An evaluation of indoor air quality (iaq) for sustainable and healthy building practices in Kaduna, Nigeria.

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ABSTRACT

Purpose: It is a study set to assess the environmental practices of selected public buildings in Kaduna, using sick building syndrome (SBS) investigation procedures as result of increasing complaints of acute discomfort in buildings and working environment equipped with air conditioning systems and other artificial environmental control systems.

Design/methodology/approach: The evaluation was based on visual inspection and administration of closed-ended and open-ended questions. Stratified sampling method was used for selecting the samples for capturing the evaluation variables.

Findings: This study evaluated the adequacy of indoor air quality and its effect related to the health of the occupants towards improving building practices. Sick building syndrome (SBS) was established as the major effect and remedial measures were suggested.

Originality/value: The study exposes the effect of sick building syndrome due to lack of adequate indoor air quality and solutions were also forwarded for improvement.

Keywords: Pollutants, Sources, Sick building syndrome, Ventilation.

1. INTRODUCTION

The effect of indoor air quality (IAQ) on productivity became an issue only in the last decade, as a result of extensive research and an understanding of the strong connections between factors such as ventilation, pollution

among others, and adverse effects on health and comfort. A 1984 World Health Organization Committee report suggested that up to 30% of new and remodeled buildings worldwide may be the subject of excessive complaints related to IAQ. (Ajimotokan et al, 2009, USEPA, 2010). Sick building syndrome (SBS) is a specific term used for the description of headache, eye ache, sore throats, breathing difficulty, cold-like symptoms and lassitude (weakness characterized by a lack of vitality or energy) experienced by occupants, without a specific illness or cause. It appears to be a reaction, at least in part due to stimulation of the common chemical sense, to a variety of chemical, physical, or biological stimuli. Its victims display all or some of a pattern of irritation of the mucous membranes, and the worst affected individuals have neurological symptoms as well (Burberry, 1975, Wood and Marc, 1999). Therefore, SBS is a combination of ailments (a syndrome) associated with an individual's place of work (office building) or residence, It must be distinguished from Building-related Illness (BRI) as it is used when symptoms of a diagnosable illness are identified and can be attributed directly to air-borne building contaminants. Both SBS and BRI must be distinguished from the term Multiple Chemical Sensitivity which is not recognized as a medical condition (Wood and Marc, 1999).

SBS can be treated from two perspectives, from the user perspective and defects in the building structure, envelope and internal environment. Buildings can cause occupants to develop symptoms because of inadequate ventilation, contamination entering from outside, or inside contamination from bacteria, moulds and volatile organic compounds (VOCs) in the building materials. Furnishings, cleaning agents and personal care products used by the occupants are no exceptions. Though, some people seem to be more at risk for SBS than others. Risk factors include having a history of allergies, being female or under psychological or social stress, handling paper, doing video display terminal work, and being in a building with mechanical ventilation or air conditioning system and a low intake of fresh outdoor air (Iyagba, 2005, Murphy, 2006, Wolverton, 1990). World Health Organization (WHO) has classified the following complaints, or symptoms, under the following categories: mucus membrane irritation-eye, nose and throat; toxic symptoms- headache, fatigue and irritability; asthma and asthma-like symptoms-chest tightness and wheezing; skin dryness; and gastrointestinal complaints. (Wood and Marc, 1999, Iyagba, 2005). SBS is recognized by the WHO as only a concern to the sufferer, but has commercial/economic implications in terms of increased absenteeism, reduced productivity, increased staff turnover or low morale.

Construction of buildings has increasingly focused on energy efficiency and comfort. Central heating and cooling systems are the norm, and home and office construction has moved toward minimizing heat or cool air loss by making buildings more airtight and at the same time more complex, with furniture, clothing fabrics, cleaners, detergents, and preservatives. These and other parallel trends have created buildings where exposure to foreign proteins, dusts, gases through inhalation has gone far beyond what historically has been the case. The types of allergies or stimuli most likely to be found in today's buildings, and how individuals can better cope with contemporary construction of indoor environments are essential.

Therefore, poor management and maintenance practices, visual environment, contaminants, and noises are also considered as causes of indoor air pollution. However, other contributing factors related to the

design of the built environment include building often contain a large number of hidden internal cavities which are formed from skeletal construction methods. Such locations may have very low direct ventilation, but air does infiltrate in and out of these spaces as ambient atmospheric pressure changes occur. (Wolverton, 1990, Iyagba, 2005).

Rise in sickness that increase absence rate, fall in Productivity, Turnover and lack of commitment due to repeated colds, headaches etc when the environment is altered are also considered as the effect of lack of indoor air quality. The control of indoor air quality is an efficient strategy of creating solutions to SBS and are usually achieved through the following or their combinations: pollutants source removal or modification, increasing ventilation rates, education and communication, dealing with potential reactions to Sick Buildings and Plants (Air Purifying Plants) have proven to be important life supporters in that they remove carbon dioxide from the air and release oxygen through the process of photosynthesis. The NASA (National Aeronautics and Space Administration) studies found that plants also work in a symbiotic relationship to remove air pollutants produced by other plants, people and industry. (SBS, 2009, Ajimotokan et al 2009, US EPA, 2010,).

Based on the foregoing we can easily visualize how the effect of indoor air quality influence the building and occupants. PBS (1995) had shown several well known cases of sick buildings in U.K and U.S.A. such as that of Norfolk House, London, England, Birmingham, Alabama Five-Ways House, Boston, Mass, EPA Building, Washington DC, and Brigham and Woman's Hospital-Boston. Perhaps, two incidences were also confirmed in Nigeria with similar concept and approach, one in Commercial Buildings of Awka southeastern region of Nigeria and the other one in Boarding schools of Zamfara state in the Northwest region of Nigeria. This has raised the question of whether the same occur in Kaduna and its environs despite the climatic, seasonal and indoor variations. As there are some complaints from occupants relating to thermal and ventilation conditions resulting to certain level of discomfort, draughts, stuffiness, headaches, general malaise and even illness. These constitute partly the objective of this assessment in Kaduna and its environs for sustainable and healthy building practices through adequate control of indoor air (Obodoh and Elueche, 2008, Ibrahim, 2009). The purpose of this research is to evaluate the effect of lack of indoor air quality through SBS resulting from its inadequacy.

2. METHODOLOGY

In order to achieve the aim of this work, visual inspection using prepared checklist and well-structured questionnaire were employed as described by Iyagba (2005). The questionnaire sought information about subjective evaluation of the working environment, health impaired symptoms, degree of control over environment and evaluation of occupants activities. The checklist captured issues such as environmental parameter, operations and maintenance, and users attitudes and information about the four basic factors that influence indoor air quality viz: occupants, HVAC system, pollutant pathways, and contaminants sources. Data was obtained from two hundreds occupants sampled randomly from four different buildings that were also selected by stratifying. One hundred and eighty five (185)

questionnaires (92.5%) were considered for analysis as fifteen were disqualified because the information given was contradicting. All the buildings surveyed are located in Kaduna, Kaduna state. The buildings are of different height with various wings used for the same purpose. A more detailed description of the buildings and study area are provided in table 1.

The data collected were analysed using a Likert rating scale, percentages, frequencies and tables for inferences, conclusion and possible recommendations. A four point response scales that eliminate the not sure/undecided category was employed based on the nature of the frequency used and to avoid interpretation/response in more than one way. The options used in the Likert-type scales were always, often, seldom and never for the causes and health-impaired symptoms of inadequate indoor air quality and on occupants' reaction to smoking and perfume.

Table 1.0: Description of buildings and study area

Buildings	Description of Buildings				Description of study area	
	No of Floors	Size GFA (m ²)	Type of Ventilation	Age (yrs)	Nature of site	Outside environment
A	6	1,650	Artificial and natural	20-30	Confine	Heavy traffic
B	10	3,960	Artificial and natural	>30	Confine	Moderate traffic with trees
C	10	5,040	Artificial and natural	20-30	Confine	Heavy traffic
D	4	2,540	Artificial and natural	<20	Non confine	Less traffic without trees

GFL Gross floor area; Source: field survey

3. RESULTS

Environmental parameters were considered to partly lead to poor indoor air quality causing sick buildings and occupants' perceptions to such parameters were assessed as presented in table 2.0 below.

Table 2.0: Causes of inadequate indoor air quality

Buildings	A				B				C				D		
	A	O	S	N	A	O	S	N	A	O	S	N	A	O	S
Too little air	4	11	15	15	2	4	13	28	1	7	15	25	0	0	0
Too cold	7	12	17	9	5	14	15	13	5	13	19	11	0	0	8
Stuffy	1	6	17	21	0	10	9	28	0	8	8	32	0	0	0
Too dim	6	6	14	19	1	8	10	28	0	6	12	30	0	0	2
Unpleasant odour	4	10	6	25	3	5	17	22	2	7	12	27	0	0	0

Key to Options: A = Always, O = Often, S = Seldom, N = Never;
Source: field survey

It could be seen that the respondents are subjected to different conditions at varying degrees in their working environment (see Table 2.0). Building D do not encountered any of the five conditions completely; this implies that the respondents to an extent are not subjected to the conditions mentioned in their working environment. These make it possible to find among the causes perceived which contribute more to the inadequate indoor air quality. Result shows (see table 3.0) that too cold has no effect in the case study with less than 40% experiencing the conditions. While other conditions are perceived to have effect with 60-70% experiencing the conditions based on the percentage average of the four buildings studied. Thus individual buildings have different dominant causes as presented.

Table 3.0 Ranking of the dominant causes of inadequate indoor air quality

Causes	A	B	C	D	total %	Ranking
Stuffy	46.6	59.6	66.7	100	68.2	1
too dim	42.2	59.6	62.5	95.6	65	2
unpleasant odour	55.6	46.8	46.3	100	62.2	3
too little air	33.3	59.6	52.1	100	61.25	4

too cold 20 27 22.9 82.2 38 5

Source: field survey

Responses to health impaired symptoms at different degrees in the buildings shows that occupants experiences the symptoms at varying level as in Table 4.0, thus workers that are more prone to headaches confirm that it usually happens in the afternoons unlike the other symptoms that were prone to always.

Table 4.0 Health-impaired symptoms of inadequate indoor air quality

Buildings Options	A				B				C				D		
	A	O	S	N	A	O	S	N	A	O	S	N	A	O	S
Sore throat	4	4	17	20	0	3	22	22	0	8	12	28	0	0	0
Skin dryness	0	6	13	26	0	7	20	20	0	5	13	30	0	0	42
Headaches	5	0	23	17	0	14	21	12	0	11	16	21	0	0	36
Drowsiness	0	6	6	32	0	3	16	28	0	1	11	36	0	0	17
Runny nose	3	3	15	24	1	2	17	27	0	1	9	38	0	0	1

Key to Options: A = Always, O = Often, S = Seldom, N = Never;
Source: field survey

The health-impaired symptoms were further ranked to see which symptom is more severe in causing effect that lead to SBS based on the four buildings studied.. Runny nose was ranked first with up to 70% of the occupant prone to it, followed by drowsiness, sore throat, skin dryness and headaches with just about 30% being prone to it. However, individual buildings have different dominant health-impaired symptoms as presented in Table 5.0.

Table 5.0 Ranking of the predominant symptoms that lead to sick building syndrome

Symptoms	A	B	C	D	total %	Ranking
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Runny nose	53.3	57.4	79.2	95.6	71.4	1
Drowsiness	71.1	59.6	75	60	66.4	2
Sore throat	44.4	46.8	58.3	97.8	61.8	3
Skin dryness	57.8	42.6	62.5	4.44	41.8	4
Headaches	37.8	25.5	43.8	17.8	31.2	5

Source: field survey

Table 6.0: Response on occupants' reactions to smoking and perfume.

Buildings	A				B				C				D			
	A	O	S	N	A	O	S	N	A	O	S	N	A	O	S	N
Perfume	12	8	14	11	8	15	8	15	11	11	17	9	13	7	24	1
Smoke	9	6	15	15	10	12	10	12	5	11	17	15	0	1	0	44

Key to Options: A = Always, O = Often, S = Seldom, N = Never; **Source: Field survey**

User activities have been said to contribute to poor indoor air quality which in turn would lead to sick building syndrome if not handled or corrected on time. Thus, perfume (scent) and smoke (usually from cigarette) were shown by this study to alter indoor air quality and the responses to that are shown above in Tables 6.0. Further analysis of the result shows that, 80.7% of the occupants react to perfume more than smoke with 53%.

However, visual inspections of the buildings disclosed that, indoors air problems are a result of poor building design or occupant activities. Results obtained in the course of the visual inspections carried out with the help of the well drafted checklist showed that provisions made for heating/cooling, ventilation, lighting, maintenance and the use of building were satisfactory in all the buildings these would have being major causes of inadequate indoor air quality which made the building to be termed 'sick'. Though, 75% of the buildings studied require some additional attention on the aspects of cleaning, furnishing and presence of contaminants.

There is up to 27% non compliance to the requirement of environmental parameters, operation or maintenance and user attitudes that are used to ascertain the SBS incidence, when 20% non compliance is established.

4. CONCLUSIONS

Incidence of the SBS in the buildings studied was confirmed as the main effect of indoor air quality pollution through building investigation procedures, walkthrough and visual investigation of critical building areas and consultation with occupants and staff. It is concluded that, working environment with excessive cold and stuffy were the more severe causes of inadequate indoor air quality. Headaches was discovered to be the most severe amongst the effects. Perfume and smoke were also found to contribute to contaminating indoor air quality. It was also discovered that, certain conditions cannot be controlled by the occupants of the building and these can result to SBS if not addressed. It is therefore recommended that occupants' education on the subject matter is necessary so as to keep occupants well informed on how to tackle such incidence, while heating, ventilating and air conditioning (HVAC) systems should be designed to meet ventilation and air exchange rate specified by appropriate code of practice.

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An assessment of risk management practices by consultants in Tanzania

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ABSTRACT

Purpose of this paper: This paper presents the findings of a descriptive study to assess risk management practices by consultants in Tanzania namely architects and quantity surveyors.

Design/methodology/approach: Qualitative research approach was used for the study to establish how consultants manage risks in construction projects. Single source of evidence was used in data collection namely interviews.

Findings: It was revealed that most consultants use document reviews and assumptions to identify risks (39.1%), contingency sum method to quantify risks (63%) and risk transfer methods such as insurance, fixed contract, bonds and guarantee to deal with risks (54.4%). Likewise, challenges to risk management were identified as inadequate risk management knowledge; not being a priority in clients' requirements; lack of holistic approach to risk management; and reluctance of consultants to spearhead risk management process.

Research limitations/implications: Findings of this paper are based on the responses of only 55 consultants interviewed. Future research using expanded sample may assist in comparison and establishing changes in risk management practices.

Practical implications: Findings of the paper provide an insight on how consultants manage risks in construction projects. The paper suggests training on risk management and inclusion of risk management plan in clients' requirements.

KEYWORDS: risk management, consultants, construction projects

1. INTRODUCTION

Risk management is increasingly becoming an important facet of project management. Authors such as Royer (2000) and Turner (1999) have maintained that risk management is an important part of project management to ensure successful completion of any construction project. Risk management should be its own process in project management, but at the same time be closely tied in all project processes and phases (Chapman, 1997; Klemetti, 2006).

Risk management process involves (PMBOK, 2000; AbouRizk, 2003; Arto and Kahkonen, 2000; Klemetti, 2006; Carter and Chinyio, 2010) risk identification, analysis / quantification, response development and control. According to PMBOK (2000) risk management plan is produced when a project manager has completed developing risk handling options and is used in risk control. AbouRiz (2003) explains that like any other plan, risk management plan should outline what is to be done, who is responsible for it, when to do it and other pertinent information.

Various studies (Finnerty, 1996; Mills, 2001; Miller and Lessard, 2001; Baloi and Price, 2003; Cohen and Palmer, 2004) have identified construction risks ranging from those occurring at pre- contract to post contract stages. Project team members are involved in risk management at varying levels. Consultants (design team and the project manager / director) manage risk from pre-contract stage to post contract stages. Likewise the construction team (Main contractor and subcontractors) manage risk at post contract stage but in most cases use the information prepared during the pre-contract stage.

As disclosed by Ashworth (1999), risk management is always overlooked on many construction projects. Despite the challenges put forward by a number of studies (Tang, Qiang, Duffield and David 2007; Malekela; 2008; Carter and Chinyio) risk management remains an important part of project management. The purpose of this paper is to find out how consultants in Tanzania manage risks in construction projects.

2. REVIEW OF LITERATURE

2.1 Risk Management Process

Risk management is increasingly becoming an important facet of project management. Royer (2000) states that experience has shown that risk management must be of critical concern of project managers as unmanaged or unmitigated risks are one of the primary concerns of project failures. This is further underscored by Turner (1999) that risk management is one of the most critical project management practices to ensure a project is successfully completed. AbouRiz (2003) asserts that risk management involves developing and implementing a risk strategy through integration with mainstream management.

Project risk management is a process that starts from the inception of the project to its conclusion. Generally, risk management process provides framework for identifying, analyzing and developing means on how to handle risks. Klemetti (2006) presents a comparison of three models (Project Business, PMBOK, and APM) outlining steps involved for improved risk management process as shown in Table 2.1 below.

Table 2.1 Comparison of risk management process

Project Business	PMBOK	APM
	risk management planning	Define Focus
Identification	Risk identification	Identify Structure Ownership
Estimation	qualitative risk analysis quantitative risk analysis	Estimate Evaluate
response planning	risk response planning plan	Plan
risk management control	risk monitoring and control	manage

Source: Klemetti (2006)

AbouRizk (2003) explains that the process of risk management involves preparation for risk analysis, risk identification, analysis, response, control and close down. Likewise Artto and Kahkonen (2000) outline risk management processes generally to include three core processes, namely risk identification, risk estimation and risk response planning and execution. Analysis of steps outlined by various authors reveals their congruence with different levels of detailing.

Another detailed risk management process model is presented by Carter and Chinyio (2010) as shown in Figure 2.1 below.

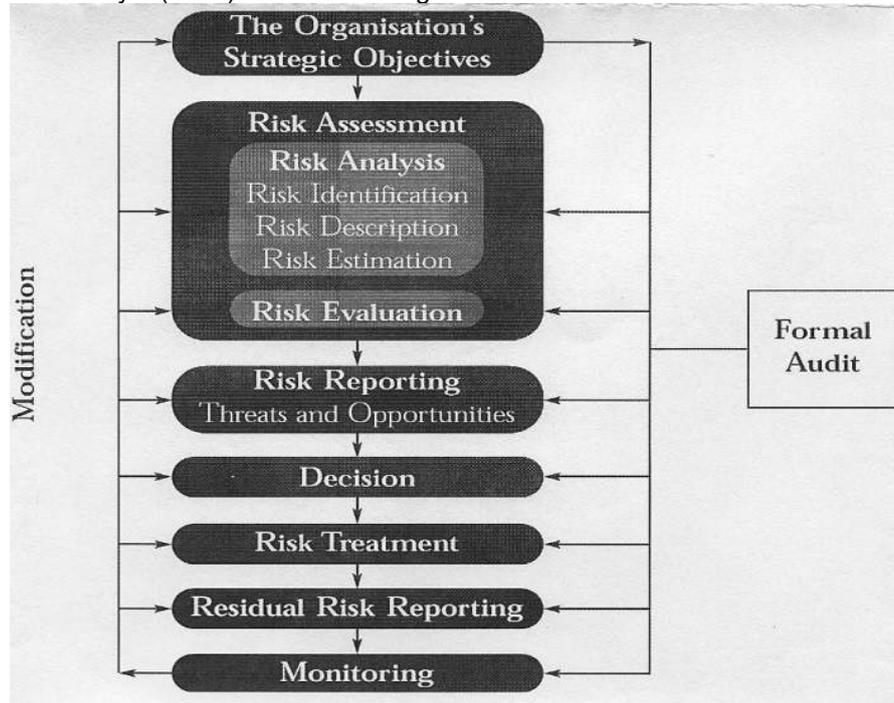


Figure 2.1 A risk management process model
Source: Carter and Chinyio (2010)

2.2 Construction project risks

Construction related activities are inherently risky emanating from design phases to actual construction on site. Cohen and Palmer (2004) identify sources of construction risks to include changes in project scope and requirements; design errors and omissions; inadequately defined roles and responsibilities; insufficient skilled staff; force majeure; and new technology. Baloi and Price (2003) categorize construction risks as technical, social, construction, economic, legal, financial, natural, commercial, logistics, and political. Similarly, Mills (2001) lists three most important risks to include: weather, productivity of labour and plant and quality of material. Other researchers such as Finnerty (1996), and Miller and Lessard (2001) have categorized same risks in addition to demand, supply, regulatory, operational, completion and sovereign. All risks categorized and other resulting from stated sources need to be well known to the project team so that they can be properly managed to enable smooth achievement of project objectives.

2.3 Involvement of consultants in risk management

According to Kikwasi (2009) a project team comprises of design and construction teams, project manager (team leader), client representative (project director) and client site representative (clerk of works) who are solely responsible for managing risks. Smith (1999) asserts that the attitude of proactive risk management in a particular project will be accomplished by the individuals who are involved in a project. The design team comprises architect, quantity surveyor, structural and service engineers who manage risks at both pre-contract and post-contract stages. Likewise the construction team (Main contractor and subcontractors) manage risk at post-contract stage.

The important step to be taken by consultants in managing risks is the preparation of risk management plan. Elyse (2007) describes risk management plan as a process which provide the blue print of overseeing risk management throughout the project describing who, what, when, where, why and how. The plan will set forth what is to be done during project execution in regard to other phases of risk management namely risk identification, analysis, response and monitoring and control. PMBOK (2000) identifies risk management planning as the first activity in risk management process. AbouRizk (2003) advocates of preparation for risk analysis an explanation that may carry risk management planning.

2.4 Challenges to risk management

There are a number of barriers to risk management identified by researchers worldwide. A study by Tang *et al*, (2007) states that current risk management systems in the Chinese construction industry are inadequate to manage project risks and lack of joint risk management mechanisms is the key barrier to risk management. Malekela (2008) identifies lack of knowledge and experience among project participants and

formal financial arrangements as barriers in managing risks in PPP projects. Carter and Chinyio (2011) identify barriers to risk management in UK construction industry as: not being sufficiently pro-active (*a lot of risk management is reactive*); not robust enough (the process is also not fully robust); attitude towards risks (the industry was seen as being risk-averse - *“too much focus on transferring risk as opposed to sharing and managing”*); and incompetence of risk managers.

3. RESEARCH METHODS

3.1 Research approach

A qualitative research approach was used to investigate how consultants manage risks in construction projects. The study design was cross-sectional. Using this design, a snapshot of how consultants in Tanzania manage risks is provided.

3.2 Sampling and Sampling technique

By August 2010 there were 165 architectural and 66 quantity surveying firms registered by Architects and Quantity Surveyors Registration Board (AQRB). A sample of 100 firms which represents about 45% of total population of 231 firms was established basing on the availability of contacts and location of to their offices. The percentage of the sample was used to determine the number of quantity surveying and architectural firms to be involved in the research comprising of 30 and 70 quantity surveying and architectural firms respectively.

3.3 Data collection technique

Single source of evidence was used in data collection namely interviews. The interview method was adopted because of the perceived notion that consultants approach risk management differently. The structured form of interview was used and both face to face and telephone interviews were conducted.

A total of 55 interviews were conducted out of 100 planned which is equivalent to 55% of the population sample. The low response to interviews was a result of many practitioners lacking time to attend interviews as most of them were either having meetings or out of their office attending project matters.

4. RESULTS AND DISCUSSION

4.1 Risk Management plan

Risk management planning is an important step in risk management exercise. Both consultants and contractors have the responsibility to prepare risk management plan for use in project risk management.

Responses on how often consultants prepare risk management plan are summarized in Figure 4.1 below.

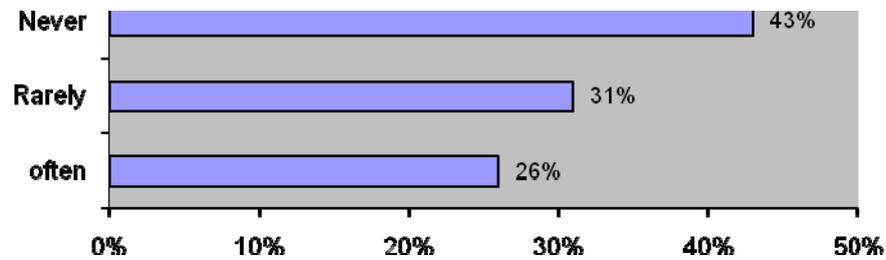


Figure 4.1 Frequencies in preparing risk management plan

Results indicate that about half of respondents (43%) never prepared risk management plan. This implies that most of consultants do not plan for risk in their projects undertakings. Bearing in mind the importance of risk management in attaining the project objectives of time, cost, quality and performance, there is an indicative evidence that lack of risk planning is among the causes of projects poor performance.

Besides, more than quarter (26%) of respondents indicated that they often prepare risk management plan. Forms with which such plan is kept are summarized in Figure 4.2 below.

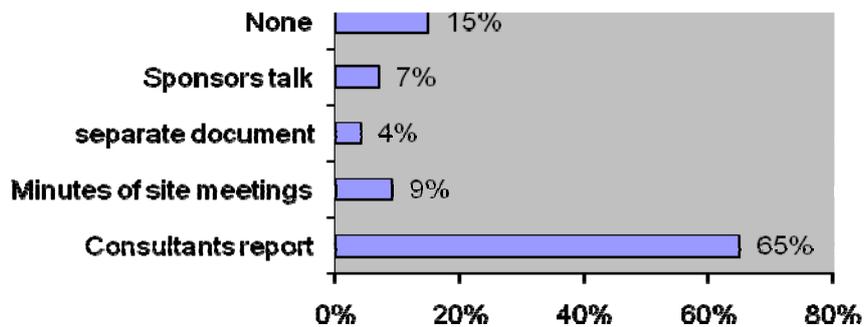


Figure 4.3: Form in which risk management plan is kept

It was revealed that more than half (65%) of respondents prepare and present their plans in form of consultant reports. This suggests that risk management is not treated as one of the major components in the project management as consultant reports are prepared to cover a variety of issues regarding the project.

4.2 Methods and techniques used in risk management

Risk management entails risk identification, risk analysis / quantification and developing risk handling options. In every stage of of risk management process, there are many techniques to be used. These need to be carefully selected to suit the project environment and available resources.

4.3 Risk identification

This involves the identification of all potential risks that might impact the project, document them and their characteristics. Figure 4.3 below indicates frequencies of risk identification in projects.

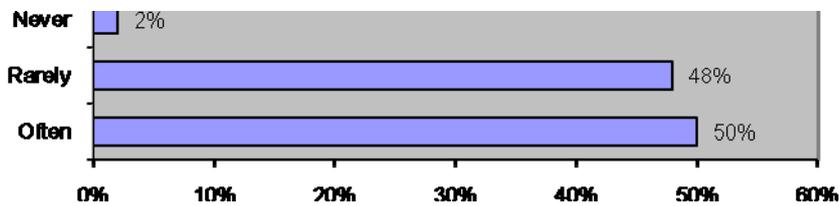


Figure 4.3 frequency of risk identification

Generally, there is an indication that half (50%) of the respondents identify risks in most of their projects and equally about half (48%) of respondents they seldom identify risks. Furthermore, a list of techniques used in risk identification was prepared for respondents to select those applicable in their projects. Their responses are shown in Figure 4.4 below.

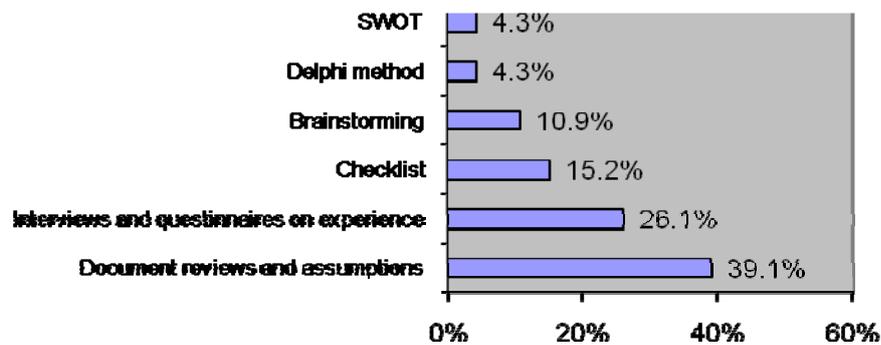


Figure 4.4 Techniques used in risk identification

Results indicate that the most preferred techniques are document reviews and assumptions (39.1%) followed by interviews and questionnaires on experience (26.1%). However, it was revealed that the two techniques lack people with proper experience and therefore there is a growing tendency of

relying on the experiences of other risk management experts worldwide.

4.3.1 Risk quantification

Risk can be analysed using qualitative or quantitative analysis. Qualitative risk analysis uses expert opinion to evaluate the probability and consequence of an event occurring. Quantitative risk analysis is a process which aims at analyzing numerically and measuring the probability and consequences of all identified prioritized risks and estimating their implications for project objectives. Responses on techniques used to analyse risks are summarized in Figure 4.5 below.

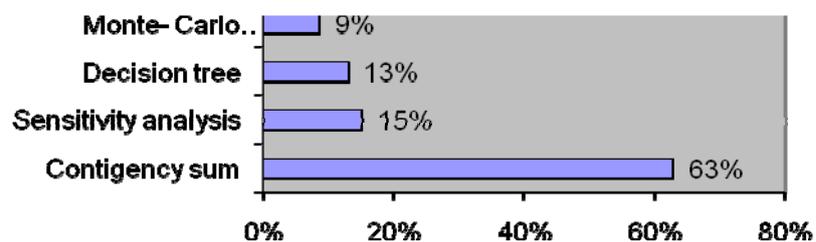


Table 4.5 Techniques used in risk quantification

Responses reveal that contingency sum method (by the rule of thumb add 10% of estimated costs) is the commonly used technique (63%) followed by far by sensitivity analysis (impact due to change / what if analysis) (15%). This supports the statement by Ashworth & Hogg (2007) that: *"in practice, the methods of determination of an appropriate contingency provision generally appear to be very crude, including the use of standardized percentage addition to the estimated contract sum"*.

4.3.2 Risk handling options

Once risks have been analyzed, handling methods need to be developed so that their effect to the project can be eliminated or minimized. Responses on techniques used in risk handling are shown in Figure 4.6 below.

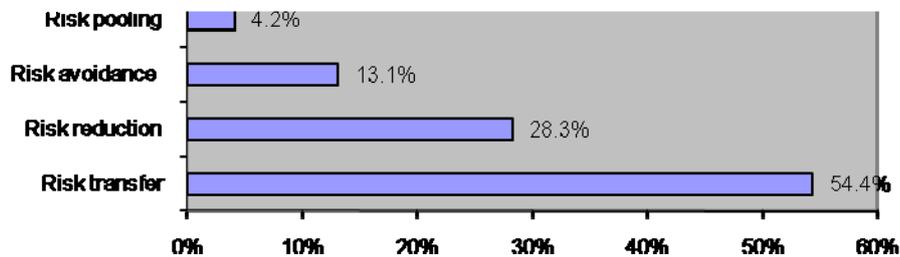


Table 4.6 Techniques used in risk handling

Risk transfer came out as the most preferred techniques (54.4%) followed by risk reduction (28.3%). Risk transfer involves provision for insurance and guarantees, and fixed contracts. This is in line with the findings of Carter and Chinyio (2010) that the UK Construction industry was seen as being risk-averse reflected in too much focusing on transferring risk as opposed to sharing and managing. These results differ from the study by Tang (2007) that the Chinese construction industry has shifted from risk transfer to risk reduction. Moreover, risk reduction comprises of actions to reduce risks such as alternative doing accompanied by demonstration events.

4.4 Project risk communication

Developing risk handling options is always followed by risk monitoring and control. Risk monitoring and control is the method of observing the roadway of the identified risks, monitoring residual risks, identifying new risks, executing risk reduction plans, and evaluating their effectiveness throughout the project life cycle. Risk monitoring and control can be enhanced through communication among project implementers. As stated by Cullen (2008) risk status communication and awareness must occur regularly as a normal part of project meetings, so as to note changes to existing risks. Figure 4.7 below indicates frequencies of including risk communication agenda in site meetings.

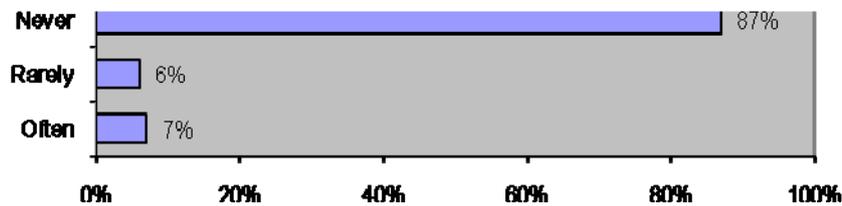


Figure 4.7 Inclusion of risk communication agenda in site meetings

Majority of respondents (87%) indicate that risk issues are not communicated during project site meetings. This suggests that risk management plans prepared once they are implemented the outcomes are not communicated to the project team members. As a result, project team members are not fully engaged in risk management.

4.5 Challenges to risk management

There are perceived challenges in practicing risk management. Respondents were requested to state challenges to implementing risk management process, based on the frequency, the following were drawn:

- inadequate risk management knowledge;
- not a priority in clients' requirements;
- lack of holistic approach to risk management; and
- reluctance of consultants to spearhead risk management process

It is evident that consultants are well placed to initiate risk management process as most of the challenges pointed out have their roots to the pre-contract stages of projects.

5. CONCLUSION AND RECOMMENDATION

Consultants in Tanzania manage risks in their projects by experience since most of them do not plan for risks. Although some have indicated that they prepare risk management plans there is no sufficient evidence that they use these plans effectively. This is evident in the techniques used in risk management process that is: risk identification – document reviews and assumption; risk analysis – contingency sum method; and risk handling – risk transfer. However, the findings of this paper cannot be generalized because are based on the responses of only 55 consultants interviewed.

Risk management being a relatively new concept in project management worldwide, its implementation comes with challenges. Challenges are due to the fact that risk management is a process of which project managers / project team members have to pursue. Consequently consultants in Tanzania are facing the following challenges: inadequate risk management knowledge; not a priority in clients' requirements; lack of

holistic approach to risk management; and reluctance of consultants to spearhead risk management process.

In view of the above findings, the paper proposes the following: consultants' professional associations need to conduct training needs assessment and conduct training in risk management. Likewise, It is high time for consultants to advise their client to make risk management a priority in project undertakings by including risk management plan in their requirements, and training institution in Tanzania include risk management subject in their curricula.

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Investigating Possible Communication Problems in the Building Team during the Construction Phase

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ABSTRACT

Purpose of this paper: To present a pilot study on the varying degrees of possible risk factors influencing project delivery through poor communication within the building team, during the construction phase (a South African context).

Design/methodology/approach: A purposive sampling of literature was complimented by response to a survey. The literature review explored concepts of communication, communication in construction, communication challenges, the building team and the construction phase. Closed-ended questions were posed to participants. Data generated was subsequently analysed using Microsoft Excel.

Findings: There are indicators of considerable poor communication within the building team during the construction phase, in the South African context. Many variables impact on efficient communication during the construction phase. There are also many potential risks associated with communication during the construction phase. Further, there is appreciable variance in the perceived levels of severity attached to each factor, possibly due to socio-cultural reasons. Moreover years of experience seem to influence overall perception of communication issues.

Research limitations/implications: (if applicable) The research was conducted as part requirement for the award of a degree within one year. As such there were limitations of time and depth. In addition the ambitious nature of the initial survey design created challenges. Response to the challenges resulted in readjustments to a more conveniently done version. Thus in-depth investigation with more representative sampling would generate more significant findings.

Practical implications: The study at the current stage provides a leap-board for more focused research, on practical issues concerning communication in construction. Through the focus of study, probable main risk factors for communication in the field aspect of construction are explored and highlighted. Possible unattended communication management needs of project management within South African context are also highlighted. The results presented here and further studies could facilitate the development of more effective communication risk management in the local context.

Value of paper: The study explores communication within the Building Team during the construction phase in the local construction context. Investigations focused on severity of factors of poor communication, which could pose possible risks to projects.

Keywords: Communication, information, risk, the building team, construction phase.

1.1 INTRODUCTION

Communication has many characteristics and numerous scenarios of occurrence. As such the concept is not easily defined satisfactorily. Communication is about the transference of information between people in different circumstances; where there is intent by one party to project some information, to be received by another. Communication's many characteristics include transfer of information, closing gaps towards a description, facilitating effective interaction, expressing facts and meanings (Dainty, Moore and Murray, 2006). Communication is also a situational and two-way process requiring social skills (Compton and Bennett, 1967). Further in (Koontz, O'donnell and Weihrich, 1984) communication is defined as information transference between a sender and receiver, which has the important element of understanding on the part of the receiver. Communication concerns the message, initiator and receptor (Compton and Bennett, 1967). Communication could thus be classified essentially as information transaction (Ozumba and Shakantu, 2009). It is therefore of key importance in life itself; a fundamental tool for the progress of human existence.

However there must be effective reception and comprehension at the receiving end of information transaction, for communication to be complete (Koontz *et. al.*, 1984). Hence the subject of communication is of prime importance in the way human beings interact, transact, express themselves and understand each other; in any given system or situation. The sphere of information and communication as described includes construction processes and the people who operate the processes. Descriptions thus far indicate that information is the clear item being communicated. In same vein, information must be communicated through a medium. There is therefore

room for vulnerability to influencing factors.

On the basis stated above, the paper presents an investigation into communication issues in construction; focused on the building team, in a pilot study. The pilot here presented is for the purpose of founding further research in the area. Further literature is carried out with a compliment of limited field work, in order to provide more understanding; which could be used for in-depth research.

1.1 THE NATURE OF COMMUNICATION

Communication occurs through written, oral and non-verbal media, which relates to the use of body language such as facial expressions (Koontz *et al.*, 1984). Communication may also be described as occurring through different mediums such as through the situation or ambience of the interaction; secondly through the use of body language and senses, expressing, receiving and processing information; thirdly in coded and also direct representation (Compton and Bennett, 1967). With modern technology other media have come into existence. New media emanate from rapid development of micro-electronics, audio and video technology, and information and communication technology (ICT) in general. Currently audiovisual communication and various forms of electronic communication are available (Dainty *et al.*, 2006). Being channels of human interaction, each medium would have its advantages and disadvantages depending on parties involved, the context and dynamics.

As indicated the preceding paragraph, information and thus the overall effectiveness of communication could be hindered by various factors. This would be active factors within the context of communication; with regards to the environment, sender, medium and receiver. The following are listed as causative factors: quality of environment, quality of information sent, technical problems, quality of reception and comprehension, and obstruction due to prejudice (Koontz *et al.*, 1984). Poor communication could be as a result of the quality of expression from the sender, or receiving and understanding on the part of receiver. Also the communication cycle might be lacking in feedback (Scott and Billing, 1998). In addition, integrity of information affects the degree of acceptance on the part of receiver (Koontz *et al.*, 1984). Further, communication is inevitably influenced by social context, being a human activity. It is also a constant activity especially on construction sites (Emmitt and Gorse, 2003). As such there are serious communication needs especially during the site stage of construction, with its extreme mobility and information intensity. Communication needs referred to include fundamental collaborative communication issues (Beyh and Kagioglu, 2004). All of the above mentioned reasons and scenarios give room for communication barriers.

In other words barriers to communication could result from semantic

distortions and use of jargons, which could be intentional or unintentional; messages being expressed poorly due to organisation of concepts, omissions and excesses of information; quality and manner of transmission; information retention capacity of the receiver; lack of adequate time for response; interpretation and acceptance of messages due to stereotypes, opinions and differences between parties; and early evaluation of message, which might be incomplete. The ambience and contextual dynamics could also generate certain attitudes such as lack of trust, threat or fear. Ambience includes differences in power, gender, physical surroundings, language and culture. Further, suboptimal / inappropriate forms of communication may be utilised due to such reasons. Moreover communication that is not well mentally processed could fail, especially when based on assumptions not clarified with the receiver (Koontz *et al.*, 1984; Dainty *et al.*, 2006). Being a process of sub-processes involving human and material resources, communication in construction is invariably vulnerable to aforementioned constraints.

1.1.1 Communication in Construction

Modern construction is increasingly more sophisticated with site populations whose diversities have spread across many demographic variables (Ozumba and Shakantu, 2008). There is higher level of complexity in modern projects than what was the case previously. Currently more professional disciplines are involved in projects. There is also more capital investment going into projects, with far more demands from stakeholders, in terms of quality and schedules (Rivers, 2008). The resultant is increased challenges for management in various areas, including information and communication (Ozumba and Shakantu, 2009). Hence construction is understandably information intensive due to the amount of data required for the sub-processes that make up the entire construction process. Firstly these processes involve many individuals, groups and organisations, which require different forms of information. Secondly distinct locations of stakeholders and participants demand long distance communications in many cases. Thirdly construction remains labour-intensive especially at site stage, which creates a social context requiring efficient communication to various members. Furthermore being that communication involves human beings; it is subject to interpretations based on knowledge and value. Such issues of interpretation are also imperative in construction communication. Moreover, construction process brings together many specialists and other professionals, in a team effort to achieve project deliverables. It is a process that operates on transaction of information. As such the team of specialists would require effective communication at any stage in the process. Hence communication could be described as a key enabler for industry performance (Dainty *et al.*, 2006).

It can be distilled from the preceding discourse that communication occurs

at interpersonal, group and organisational levels. Higher levels of communication would understandably occur at inter / intra-organisational levels, cross-industry / sector, among others. This would be true especially in construction with its project-based / ad hoc relationships. At whatever level communication occurs, it will involve processes, influencing factors and other exigencies described.

2.1.2 Communication within the Building Team

Construction process involves groups of diverse people who work together to achieve the project goals. During the construction / site production stage of the process the stakeholders would be represented by the project / building team. Such groups are made up of people from various backgrounds, skills, aptitude, competence, understanding, and vernacular (Dainty *et al.*, 2006). In any project, the building team would be made up of different people such as designers and other consultants, client, contractors and project management staff (Dainty *et al.*, 2006; Cornick and Mather, 1999; Emmitt and Gorse, 2007). Team performance would most probably improve as the group matures through the course of the project. As maturity occurs different roles of team members would emerge. Some of the factors that influence communication in the building team are the formal nature of the group's constitution; different roles of individuals in the team, which determine formal lines and types of communication; influence of informal lines and positions of communication; and general group dynamics which varies with each team (Dainty *et al.*, 2006). Information and communication processes required for projects are substantially generated and operated within the building team. This team of professionals have specialists in different aspects of any project. The building team brings the advantage of wide ranging inputs to the end product, due to diversities included (Cornick and Mather, 1999; Emmitt and Gorse, 2007). However members of the building team have to communicate effectively with each other. Coming from various intellectual, language, social and disciplinary backgrounds; there are bound to be communications challenges within the team. In addition the use of different languages, jargons and different technical terminologies for the same item results in confusion within the project (Emmitt and Gorse, 2007; Turner, 1999). Lack of proper conflict resolution and communication skills would adversely affect desired outcomes of any relationship; both in organizations and industries. Thus communication problems arising between members of the building team in a project, would affect project delivery if not remedied expediently (Alshawi and Ingirige, 2003). In addition to issues raised, construction industry characteristics accentuate communication challenges. Firstly projects are essentially once-off and are engaged upon in ad hoc nature with regard to the building team. Secondly projects are awarded on relatively short notice leaving the participants little time to go through the necessary process of group communication maturity. Thirdly construction is

labour-intensive and continues to rely on a highly mobile workforce (Dainty *et. al.*, 2006).

2.1.3 Communication in the Building Team during Construction Phase

Within project life-cycle, construction activities on site fall under the implementation phase. The implementation phase is probably when the project is exposed to the most risks. Among many factors affecting a project during the implementation phase would be; delays in the delivery of materials, labour strikes or delays caused by poor communication within the building team. From inception through hand over, the construction phase probably produces the highest intensity in information exchange and physical exertion. It is the culmination of preparation and planning efforts; which stations the contractor to interface between the very important processes of design and production. Communication problems are most likely to occur at this stage due to high volume of information exchanged and the stress of work environment (Emmitt and Gorse, 2007; Love, Irani and Edwards 2004). In the event of communication problems, successful project management is hampered; since communication and management are intertwined (Tixier, 1994). Further, information and effective communication could be described as bedrock of quality management (Winch, 2010). Therefore within construction, one of the noted key management areas that require precise systems and procedures is information and communication management (Griffith, Stephen and Watson, 2000).

It is arguable that within the pressures of a process such as construction; risk of poor communication would most probably emanate from interpersonal and group levels. Also a substantial part of communication in construction could be subject to interpretation though usual references are made to technical issues. As such sources of project level communication problems would most probably be poor interpersonal communication within groups that make up the project. In (Koontz *et. al.*, 1984) improving communication generally in an organised situation is described as requiring an assessment. Auditing of the current communication system will produce information about sub-systems and networks, which provide a foundation for necessary adjustments within context. Further interventions such as application of effective communication techniques at interpersonal level could also be used to address problems.

There is availability of literature internationally in books and other academic publications, in the area of communication in construction. However there is scarcity of information focused on specific areas, stages

and contexts of communication in construction; such as the building team during the construction phase, in the context of South Africa.

On this background, a research agenda was set up with the overall aim of investigating communication issues at various stages in the entire construction process. The view spans both basic and advanced concepts of construction communication; looking at different information transactions involved and problems that could arise. Investigations are also conducted within the context of South Africa, being an emerging economy and a multicultural society. Findings are here presented, of a pilot study on communication issues within the building team during the construction phase.

3.1 METHODOLOGY FOR THE STUDY

A limited study was carried out towards the aim described in the paragraph above. Being a preliminary exploratory study, focus group discussion and survey by questionnaire was utilised. Investigations on the said communication issues were addressed from respondents' point of view. Investigations focused on potential risk factors, which could lead to time, cost, quality and legal problems. Other variables / parameters included are potential risk of occurrence, and frequency of occurrence. An appreciable list of possible factors was compiled. Each factor was examined across the six parameters mentioned above. The severity of individual factors under each parameter was derived from respondents' perception. The aim was to achieve a classification of factors of poor communication, which could be useful for further studies towards identifying possible communication risk factors.

Apart from issues discussed earlier in the paper, additional areas of investigation were derived such as: Lack of adequate communication; additional expenditure due to reworking; construction drawings being superseded; lack of integration within the supply chain; the introduction of automation into management practices; electronic communication versus culture; lack of software integration; and lack of a standardized platform for information exchange (Alshawi and Ingirige, 2003).

Firstly a small focus group consisting of 6 professionals with experience in various building teams was carried out. The research topic, questionnaire and interpretation were discussed. Views of the professionals were used to further the study. Through deliberations it was decided to first confirm the nature and severity of negative communication issues within the building team during the construction phase. A Quantitative approach was used to collect data for analysis. Structured questionnaire with close-ended questions was used in data collection. Respondents were asked to rank the severity of individual factors for all six parameters / variables. The ranking was restricted to a scale of 1 to 5, with 5 representing highest degree of

severity. For the purpose of the pilot, questionnaire scope excluded factors that were deemed external and / or uncontrollable within the context of study. Such factors include unforeseen circumstances, government controls and economic or globalization dynamics. Issues investigated are here referred to as factors of poor communication within the building team during the construction phase. The final tally of factors investigated were twenty six in number covering issues drawn from literature review and focus group discussion (see figure 3.1).

Table 3.1 Factors of poor communication investigated

1	New industry Jargon	14	Lack of leadership by Project PM
2	Too much information to translate	15	Poor Distribution of Information
3	Closing performance reports on project	16	Bureaucracy [long chain of command]
4	Incompatible Software and file types	17	Constant interference from client
5	Poor expression of Message/instruction	18	Personal clashes
6	Lose track of main aim in site meetings	19	Members not updated immediately
7	Relaxed team culture or attitude	20	General Mistakes
8	Incomplete Project status reports	21	Too many Communication Channels
9	Lack of a formal & professional tone	22	Tension
10	Wrong translation or interpretation	23	Inefficiency
11	Unclear mandate from design stage	24	Changing structural drawings & specs
12	Differing work ethics	25	Stressful working environment
13	Poorly defined Communication Plan	26	Information not received on Time

For each of the twenty six factors investigated, the following parameters / variables were used: Ranking for potential risk of occurrence; ranking for frequency of occurrence; and ranking for factors resulting in legal action, delay, cost overrun and shortcomings in quality.

3.1.1 Scope, Sampling and Response

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Geographical scope of the investigations was within Gauteng region; specifically the greater Johannesburg area of South Africa. Investigations initially set out with an ambitious sampling approach, which encountered reasonable challenges of time, logistics and other resource constraints within the time set out for data collection. Sampling was then adjusted to a more conveniently done version.

Respondents to the questionnaire were construction professionals who have been, or were currently part of a building team. Respondents included architects, construction managers, quantity surveyors, engineers and project managers with working experience in the focus area of study. Survey questionnaires were distributed primarily through electronic mail. Some questionnaires were also delivered by hand to potential respondents. Fifty (50) questionnaires were distributed by electronic mail and ten (10) were returned completed. Twenty five (25) were hand delivered with fifteen (15) being completed and returned. The small pool was deemed sufficient for such limited exploratory study, based on the purpose of this initial study. Also within the context and purpose of the pilot, the questionnaire demanded considerable devotion of time to complete. However response received throws light on the issues investigated. For example some of the responses had markings next to specific factors. Others had Values of six (6) with an exclamation mark; though maximum ranking of severity for any factor in the questionnaire was five (5). Some responses had ratings such as two point seven (2.7), which served as positive indication of mental effort applied in responding to questions.

Demography of respondents was not based on individual disciplines / professions within the building team. It was deemed not to be as useful as the work experience for the very limited scope of this initial study. Considering the small pool of twenty four usable responses, respondents were categorised along time frame of work experience. Essentially two groups of respondents were used:

Group A [eight months to two years experience] – 12 respondents

Group B [four years and above of work experience] – 12 respondents

In Group A, 46% of respondents did not answer questions relating to inefficiency and tension within the building team. In same way 50% of the respondents did not answer questions pertaining to Legal Action and Potential risk. However in group B only 17% of respondents were blank on questions of Efficiency, Tension, Legal Action and Potential risk. Generally Group A responses were limited to *Time*, *Cost* and *Quality* questions. Group B responses spread most across all parameters.

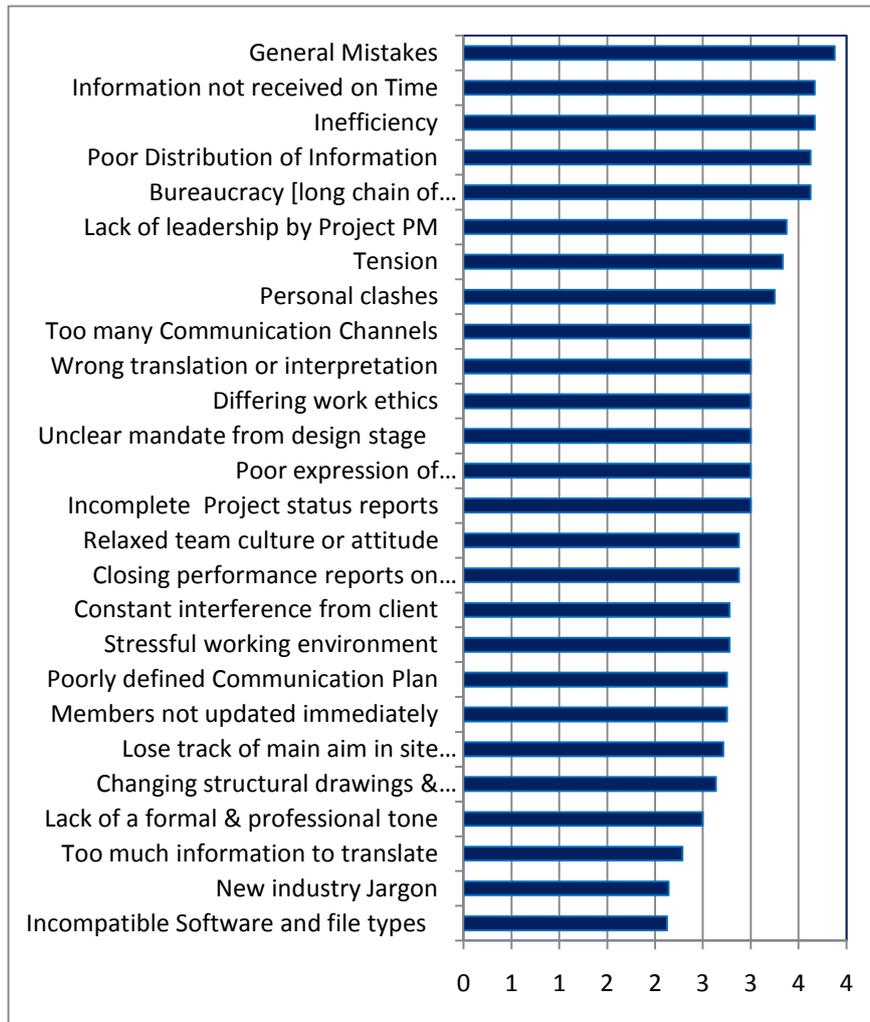
Though the rating system adopted for the study had a maximum of 5, extra ratings given by respondents were used in some cases. Accommodating extra ratings in some instances rests primarily on the phenomenological nature of the study carried out. Thus extra ratings were

accommodated in the analysis, where they were deemed to facilitate better understanding. The patterns described seemed to follow the relative years of work experience. Results of analysis are presented in the following pages.

4.1 DATA ANALYSIS, FINDINGS AND DISCUSSION

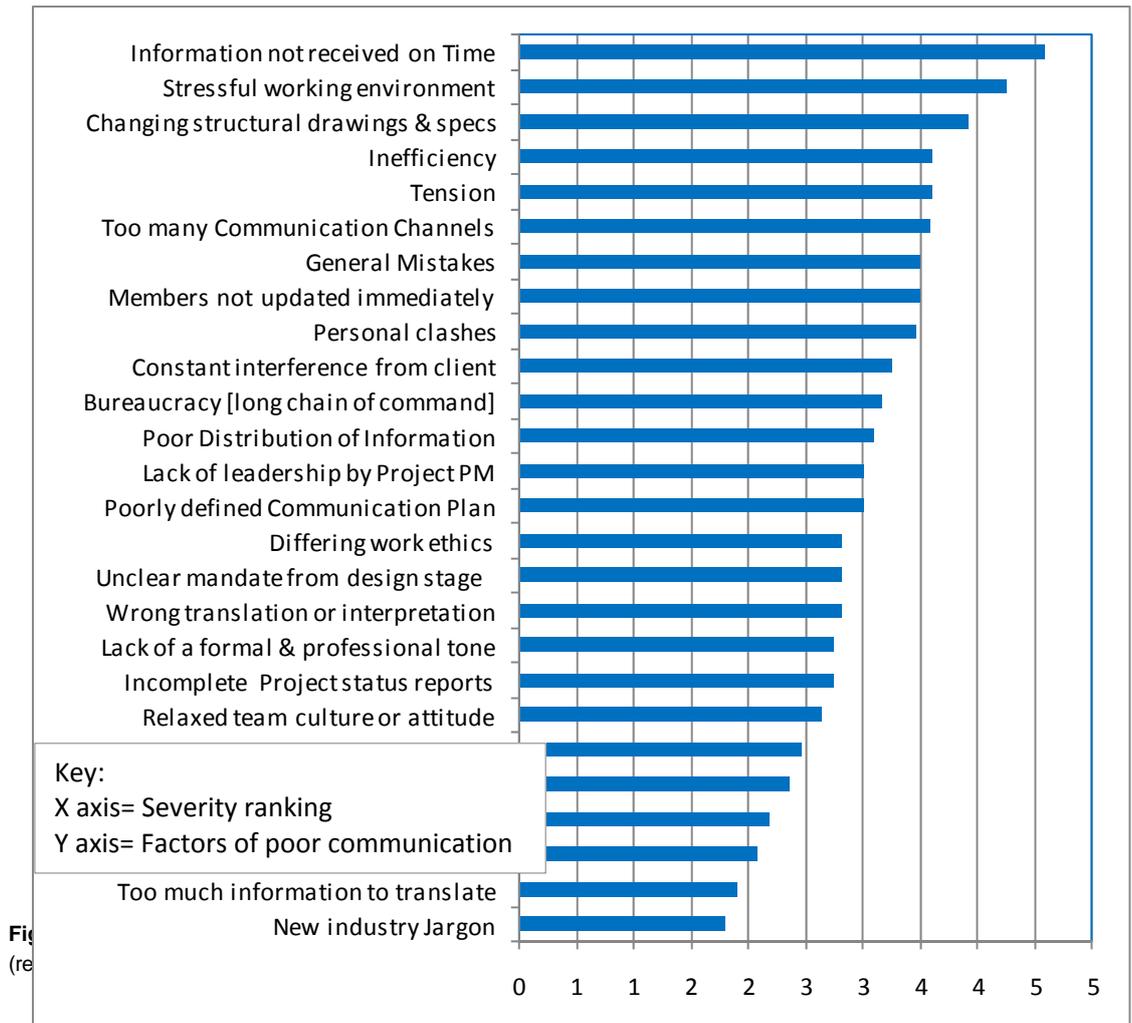
Generally the factor, “New Industry Jargon” had a grand total average ranking of 2; making it the lowest ranked in severity. “Information Not Received on Time” had the highest grand total average ranking of 4. In addition total spread of severity for all factors, indicates an even spread of possible causes and effects / symptoms of poor communication.

In figure 4.1 below for potential risk of occurrence, “Incompatible Software and File Types” and “New Industry Jargon” were the lowest with an average rating of 2.60 each. The second highest rated item was “Information not received on Time” with an average rating of 4.10. The highest rated item was “General Mistakes” which had an average rating of 4.40.



Key:
 X axis= Severity ranking
 Y axis= Factors of poor communication

Figure 4.1 Factors of poor communication (respondent's perception).



In Figure 4.2 for frequency of occurrence, “New Industry Jargon” had the lowest rating, with an average of 2.30. “Too Much Information to Translate” had the second lowest average rating of 2.45. The second highest rated item was “Stressful Working Environment” with an average rating of 4.60. “Information Not Received on Time” was the highest with an average rating

of 5.10, based on extra values added by some respondents. However it is regarded as having the full value for severity. Other variables investigated in the study are not presented in graphic form. Their results are presented in text form below.

4.1.1 Time, cost, quality and legal action parameters

With regard to time parameter, "New Industry Jargon" had lowest rating of 2.10. Second lowest rated item was "Tension" with an average rating of 2.40. "Information not received on Time" was the second highest rated item with a 3.30 average rating. "Changing Structural Drawings and Specifications" was highest with an average rating of 4.30.

Under cost parameter, "Too Much Information to translate" had the lowest with an average rating of 2.20. "New Industry Jargon" was the second lowest average rating of 2.30. Second highest rated item was "General Mistakes" with an average rating of 4.10. "Changing Structural drawings and Specifications" was again the highest with an average rating of 4.50.

In the area of quality, "New Industry Jargon" was also lowest with an average rating of 2.00. "Tension" had the second lowest average rating of 2.20. The second highest rated item was "Lack of Leadership by Project Manager" with an average rating of 3.60. "General Mistakes" was the highest rated communication problem under quality, with an average rating of 3.80.

With regard to severity of factors in leading to legal action, the lowest rated item was "New Industry Jargon" with an average rating of 1.70. The second lowest was "Incompatible Software and File Types" with an average rating of 1.80. "Inefficiency" was highest rated at an average of 3.40. while "Information Not Received on Time" second highest at an average rating of 3.30.

Figure 4.3 represents percentage ranking of the top eight factors averaged across all variables measured. Information not received on time is the highest with a percentage rating of 5.25% followed by general mistakes; changing structural drawings; lack of leadership; poor distribution of information; long chain of command; wrong translation or interpretation; and too many communication as the lowest with 4.06% rating.

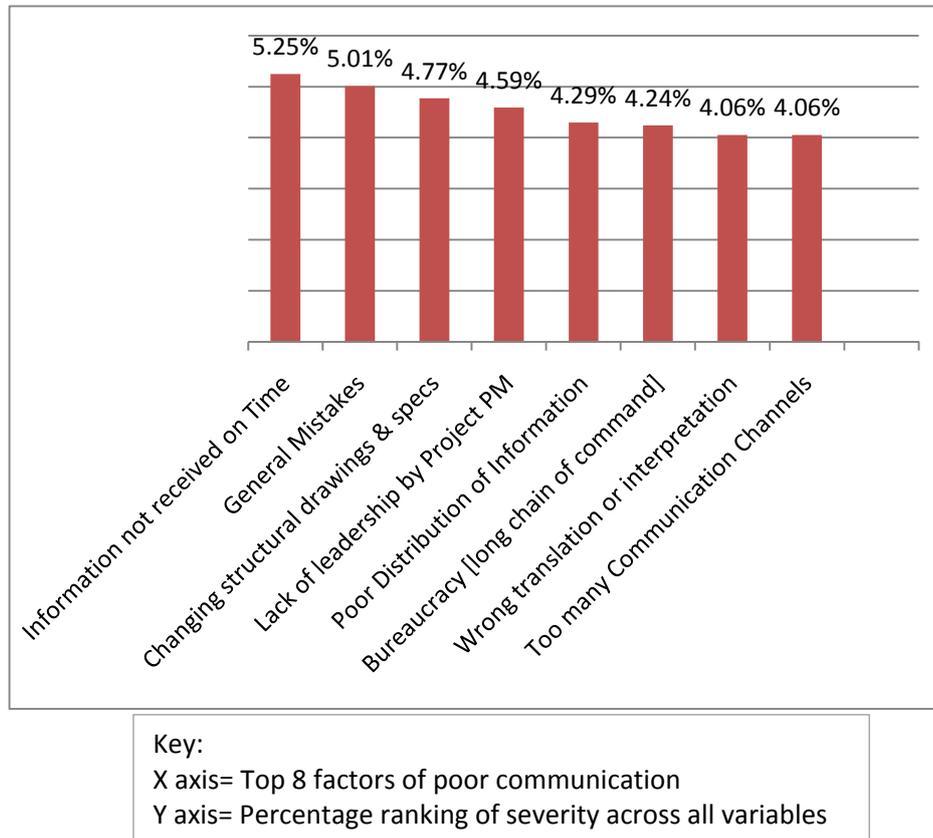


Figure 4.3 Top eight factors by percentage ranking severity averaged across all variables.

4.1.2 Findings and discussion

In line with the wider objective as described earlier in the paper; respondents' assessment of potential risk and frequency of occurrence for all communication factors was studied. Top five communication factors by respondents' perception, which present the most risk in descending order, are: General Mistakes, Information not received on time, Inefficiency, Poor distribution of information and Bureaucracy (long chain of command). Communication factors here mentioned fall mainly within the technical and managerial area of projects. Secondly top five factors perceived by respondents as occurring most frequently, are in descending order: Information not received in time, Stressful work environment, Changing

structural drawings and specifications, Inefficiency and Tension. Factors mentioned here fall mostly within the technical and socio-cultural aspects of the project. It is arguable that management spans both aspects. Invariably all aspects are interconnected. Thirdly relationships of responses for the two variables are indicative of deeper meanings attached to the term "Risk" with regard to communication. Out of five top factors indicated under both parameters, respondents agree totally on only two (Information not received on time and inefficiency). Frequency of occurrence as a question is more quantitative in nature and thus easier to answer. However the term risk would require more mental application. Respondents would have to draw meanings from experience and impact felt. In some cases the meaning of the term and therefore how it is measured in the mind of the respondent might have emotional input. Albeit, there is a seeming trace of consistency in the ranking for potential risk (see figure 4.1) and general spread (as partly described in first paragraph of section 4.1). Further consistency is also indicated when comparing the top ten factors measured in figures 4.1 and 4.2. The two charts share six factors, though not in the same order of magnitude by ranking.

Apart from other analysis not presented here, a simple matrix was used to further consider all six variables (risk, frequency, time, cost, quality and legal action). Six top factors of poor communication were derived by taking the top two ranking factors under each variable. Communication factors were placed vertically while variables were placed horizontally. Points of agreement for variables across all six factors were used to further analyse and rank factors; and also consider their consistency across the variables.

Table 4.1 Matrix table for agreement of ratings for factors of poor communication in terms of variables measured.

		Variables measured in the study					
		Risk	Frequency	Time	Cost	Quality	Legal action
Six top factors of poor communication	General mistakes	X			X	X	
	Information not received on Time	X	X	X			X
	Stressful work environment		X				
	Changing Structural Drawings and Specifications			X	X		

	Lack of Leadership by Project Manager					X	
	Inefficiency						X

From the matrix table 4.1. “information not received on time” ranks highest with 4 points, having the most consistency across all six variables. General mistakes ranks second with three points while changing structural drawing and specifications ranks third with two points. The rest have one point each. Within the context of the study, timeliness of information sits generally at the top area of core issues in poor communication and its impact. Changing the working documents is another strong factor. However the case of general mistakes would need further detailing, which could be embodied in further studies.

5.1 CONCLUSION

The limited study presented here focused on discovering possible factors of poor communication; which could be further investigated and analysed in terms of communication risk factors. Other preliminary analyses carried out are not presented here. However, all add to the information now available for the ongoing work. Limitations of time and resource were encountered, in addition to the challenges faced during sampling and data collection.

However at this juncture, with regards to the wider study, certain assumptions can be safely made with regard to the research focus. The assumptions serve as conclusion for the paper and will partly guide further research. They are as follows:

- i. That communication is one of the most important tools used by the building team, especially during the construction phase of a project;
- ii. That many factors (including those investigated) have varied impact on efficient communication within the building team at the site stage;
- iii. That factors investigated are indicative of specific communication problems (which could be viewed in terms of being purely technical, managerial, socio-cultural and other perspectives).
- iv. Degree of potential risk of poor communication would vary according to each communication factor.
- v. Considerable amount of human perceptions and responses go into what eventually become communication problems; and its effect on a project.
- vi. Leading factors and most probable consequences will vary with other variables.

- vii. Perceptions of the severity of each factor by individuals in the building team vary.
- viii. Variance in perceptions would be due to period of working experience, role and position in projects, among other reasons.
- ix. Variance in perceptions will ultimately influence response to symptoms of poor communication within the building team during the construction phase. In line with moving the research forward, there should be further activity towards improving the data collection method to achieve better representation. Demography of sample population should have adequate representation of all relevant participants for each stage of the construction process studied. Risk management concepts should be applied at such stage in order to perform proper identification and analysis.

Within the South African context, there is need to pool experience of participants at each stage of the construction process in this regard. There is need to categorise communication risk factors, for use in managing communication in project teams. Ultimately there should be a progression of the research towards developing a communication risk management framework for construction project implementation. Such framework should accommodate socio-cultural and experiential groupings of factors, in addition to others.

The study forms part of an honours degree research work carried out in 2009. Data collection and preliminary analysis for this pilot was done by the lead author and co-author 2, supervised by co-author 3. Further theoretical work and analysis of existing data, as partly presented in the paper has been carried out by co-author 3. The research is currently being carried forward by co-author 3, accommodating Construction Information and Communication technology (CICT).

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ASOCSA2011- 43

Assessment of Maintenance Practices on Public Buildings: A case-study of correctional institutions

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ABSTRACT

Purpose: The study assesses the practices of maintenance culture with the set objectives to examine the operational state of the buildings and the factors affecting the maintenance practices of the correctional buildings in Lagos state.

Design/methodology/approach: Recent literatures on maintenance practices were reviewed. A quantitative approach is adopted for the study that allows the researcher to administer questionnaires to investigate respective respondents (users'/occupants and maintenance personnel) of the prison within the selected sample.

Findings: It was revealed that maintenance personnel perceived the physical condition of the buildings to be better as compared to how it is perceived by the users'. The responses from maintenance officers are statistically different from the users' on the factors affecting maintenance practices of prison buildings.

Research limitations/implications: The use of electronic device such as camera to take physical pictures of building elements/components that will reveal the present state was denied for security reasons.

Practical implications: The study reveals the present status of the prison and showcases how a conducive environment will support the aim of establishing prison system in Nigeria.

Originality/Value: The performance of prison buildings and their components depend on continuous planning and execution of repairs so that the buildings remain preserved in its initial effective state.

Keywords: Prisons, Maintenance Practices and Correctional Buildings.

1.1 RESEARCH BACKGROUND

One of the cardinal objectives of the prison system is to wear away prisoners from crime and other anti-social activities and give them direction that will enable them live a normal life again (Anon, 2000).

Investigation into Nigeria's penal system investigation reveals that rather than being reformatory and rehabilitative, the system is punitive, degrading and dehumanizing. According to Agomoh and Oghozor (2006) the functions of Nigeria prison are to keep in safe custody of person legally interred, to identify the causes of their inherent anti-social behaviour, treat and reform them to become law abiding citizen of a free society, to train them towards their rehabilitation on discharge and, to generate revenue for government through prison farms and industries.

Maintenance has been defined and redefined by various authors. However, all definitions revolve around building care. A building is an asset whose values changes with respect to the quality and quantity of maintenance and repair works carried out on them (Abdul Lateef, Mohd Faris & Arazi, 2010)

The British Standards Institution (BSI) gives a widely adopted definition of maintenance. The BSI and HMSO defined maintenance as work undertaken in order to keep or restore every facility i.e. every part of a site, building and contents, to an acceptable standard and to sustain the utility and value of the facility (BSI, 1984; HMSO, 1972).

Crips (1984) also defined building maintenance as the regular inspection of all parts of a building and execution of work necessary to keep the structure, finishes and fittings in a proper and acceptable state of repair, including decoration both internally and externally. Maintenance is the action of performing activities to keep the system operational.

Maintenance management involves decision making by the maintenance manager under multiple objectives and uncertainty, in addition to budgetary constraints (Lounis & Vanier, 2000). Maintenance management seeks to plan, control, coordinate and organize maintenance activities focusing on efficient allocation and utilization of resources in order to improve the value of a building (Abdul Lateef, Khamidi & Idrus, 2010)

Maintenance of facilities in Nigeria's Prison system as in most third world countries is inadequate, this inadequacy of operation and maintenance of infrastructure in developing country has serious consequence for economic and social development.

To achieve the Nigeria's prison functions, the assets of the prisons must be adequate. Prison buildings constitute a significant part of the asset. These prison buildings' fabrics and services require maintenance to ensure continued peak performance of the buildings that support custodial,

reformatory, rehabilitative, and revenue generation. The need for attractive and conducive facilities and environment places new demands on maintenance managers, requires that they adopt more systematic and proactive approaches to their work

1.2 Statement of the Research Problem

Prisons are microcosms of society, and confined population generally requires many of the services and amenities that contemporary society offers population outside of prison (William, 1994).

The prison facilities provided by the government are few compared to the population of in-mates in custody. While trying to improve the state of the prisons and the welfare of in-mates, it is very important to note that any reformation or rehabilitation that is anticipated can only be achieved in conducive environment. As such, the state of the building and its facilities ought to be improved hence maintenance management of prisons is therefore paramount.

1.3 Aim and Objectives of the Study

The aim of the study is to assess the practices of maintenance of prison buildings. In achieving this, the following objectives were set out:

1. To examine the operational conditions of prison buildings
2. To identify factors affecting maintenance management practices of the prison buildings in the study area.

1.4 Research Hypotheses

1. There is no significant difference in the operational condition of the prison buildings.
2. None of the factors affecting maintenance practices of prisons' building is more significant than the other.

2. Prison Buildings in Nigeria

The prison system is a creation of the need for a structured environment where those who commit offences inimical to the society are put away, to get reformed before being allowed to return to their various communities (PRAWA, 2000).

The major problem confronting the Nigerian Prisons service is the rate of overcrowding to available prisons facilities which according to release of Prison statistic, stood at over 60% of the total inmate population. The year 1999, during the civilian administration of Chief Olusegun Obasanjo the fortune of the Nigerian Prison changed as leadership of the country changed. Presidential committee on prison decongestion recommended over 8000 prisoners for release. It was also proposed that the 144 prisons

in Nigeria should be assessed and evaluated as a step towards achieving modernization of prison buildings and that renovation work should be carried out on prisons particularly those built during the colonial era (The Presidential commission, 2006).

The performance of prison buildings and their components depends to a large degree on continuous and planned periodical maintenance, the management of maintenance by various levels within structure of the organization, which challenges government and maintenance managers to institute precise planning based on a well-structured maintenance program. It is important that the prison is suitable for holding prisoners and that improvement to the prison buildings are made to meet changing needs and appropriate legislation. Maintenance management issues play a major role in the performance of constructed facilities (Shohet, Lavy-Leibovich & Bar-On, 2003) and as such development in the prison buildings should be part of the strategic plan and there should be a planned preventative maintenance scheme in place (PRAWA, 2000).

2.1 FACTORS AFFECTING MAINTENANCE PRACTICES

Mushumbusi (1999) and Adenuga, Odusami & Faremi (2006) pinpoints the following factors affecting maintenance practices.

- General apathy, ignorance and disregard of maintenance work. This explains why our facilities are in deplorable state crying for maintenance.
- Poor funding of prison maintenance unit.
- Constraints on resources
- Funding constraints
- Shortage of Man power/ staffing
- Lack of skilled manpower to undertake work especially in prison buildings designed and constructed by expatriates.
- At design and construction stage, maintenance of prison buildings is not considered.
- Design problems- These type of problems are usually hard to solve as it may involve complete reconstruction of element of the building or large sections of it. This may be avoided or reduced by involving at the design stages professional experts, including highly competent and experienced managers.
- Attitudinal problems: The attitude of the public toward public prison buildings, to say the least, is negative and generally retrogressive.
- Problems emanating from Political Decision: Certain obsolete equipment and project designs are imported owing to the preponderance of undue political influence or consideration on what should have been purely technical decisions.
Other factors influencing prison maintenance practices include;
- Ignorance or basic physical and chemical properties of materials: One of the major causes of building deterioration and other

unsatisfactory features of many buildings is bad understanding of the nature and behaviour of materials. Failure to make allowance for the differing thermal and moisture movements of materials in combination adversely affects a building's functional performance or appearance (Lee, 1992).

- Usage of new materials with insufficient information: Availability of new materials with little information about their behaviour and characteristics. Most times, these materials are relatively untested and with inadequate guarantees. The use of such materials can mean a never-ending cause of maintenance problems (Mahmoud, 1994).
- Faulty design: Faulty design includes all defects caused during the early stage of design, particularly in the structural design. An example of this is when the designer ignores the spacing for contraction and expansion movement. Such movement causes cracking of the structure, which will result in fractures in pipes or joints (Ikwan, 1996)
- Poor quality control: Quality control is the process used to control, inspect, test and record procurement, fabrication and installation in conformance with the contract documents. A facility monitored by effective quality control program has fewer defects and therefore requires less maintenance than a facility where no quality control program has been considered. Quality control is vital to ensure that the components required are maintained in basic accordance with the requirements of the contract documents (Mohmoud, 1994).
- Non-availability of skilled labour: The need for skilled labour for maintenance work cannot be over-emphasized. They should be available to perform job and utilize equipment. The employment of labour with the requisite skills will assist to improve the quality of work, minimizing cost and reduce work time span. Therefore, just having the right tools does not mean the job will be performed properly but also armed with the right men to do the job
- Poor financial support for maintenance work: It is very important that building owners, while preparing annual budgets, include enough financial allocation for maintenance work, as it is a critical and needed function. In the absence of financial support for maintenance work required, the building will not be maintained properly.

3. METHODOLOGY

The methodology of the study involves a review of literatures and a pilot study administering a structured questionnaire on maintenance department and user's/occupants of correctional buildings in a convenience sample in Lagos state, Nigeria.

The state prison consists of five prisons and the state command. The maintenance personnel cut across all these five prisons and state

command. For the pilot study survey, one of the prisons was selected. Two sets of questionnaires were designed for the pilot study, one for the users of buildings and the second for maintenance officers. Both questionnaires assess the operational state of the buildings and the factors affecting the maintenance practices of the correctional buildings in Lagos state.

3.1 Prison's Characteristics

Responses obtained from the users of prison buildings and maintenance officers include type of prison, number of employees in each department and numbers of buildings that are maintained by maintenance departments. Thirty seven prison buildings users were contacted for this pilot field survey primarily from male inmate medium prison, Kirikiri. Responses from maintenance officers cut across all prison located in Lagos state. Ten respondents from male inmates' prison (maximum, medium, Ikoyi), five respondents from Lagos prison command and two respondents from female prison.

Table 1.1 *Prison characteristics*

Prison's characteristics	Users	Maintenance
Type of prison		
State command		5(24.4%)
Male inmate only	37(100%)	10(58.8%)
Female inmate only		2(11.8%)
Total	37(100%)	17(100%)
Number of employees		
Less than 10	5(15.6%)	7(46.7%)
10-19	7(21.9%)	3(20.0%)
20-29	8(25.0%)	
30-39	9(28.1%)	1(6.7%)
Above 40	3(9.4%)	4(26.7%)
Total	32(100%)	15(100%)
Number of buildings		
Fewer than 5		2(11.8%)
5-14	23(69.7%)	6(35.3%)
15-24	10(30.3%)	4(23.5%)
25 and more		5(29.4%)

Total	33(100%)	17(100%)
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3.2 Objective One

Analysis of operational state of building elements and services of prison buildings.

The first objective of this pilot study is to examine the operational state of prison buildings. This operational state of the prison buildings depends on the physical and functional conditions of all the building elements, services and the immediate environment of the buildings. Maintenance officers of maintenance department and the users of prison buildings were asked to rate the physical conditions of building components in a likert scale using (i) Very bad (ii) Bad (ii) Neutral (iv) Good (v) Very good

Comparison of the perception of users and maintenance officer on physical conditions of the prisons was carried out.

Mean item scores was calculated for operational state of prison building according to the response given by the users and the maintenance officers of the prison building. The scores are arranged based on the score ranking of the responses by the users. Accordingly, the following are in good state as identified by the users; floor finishes, walling, floor slab, roof coverings, roof structures, safety & security of the environment, beams & columns, internal partitions, level of cleanliness, air circulation, external painting, ceiling, windows, doors and solid waste disposal. On the other hand, safety & security of the environment, doors, level of cleanliness, internal partitions, floor slab, beams & columns, windows, walling, roof structures, roof coverings, ceiling, floor finishes, air circulation, water supply, sanitary fittings and waste water disposal, are identified by the maintenance officers to be in good order. It can be deduced that generally, roof structures, roof coverings, ceiling, floor slab, floor finishes, walling, beams & columns, internal partitions, doors, windows, level of cleanliness, air circulation (ventilation) and safety & security of the environment are in good operational state in the Nigeria's prison.

Areas identified to be in bad operational state are netting, firefighting equipment, telecommunication systems, and alarms & detector.

Table 1.2 Mean scores for operational state of physical condition of prison

Components	Number of users	Number of officers	Mean of users	Mean of officers	Mode of users	Mode of officers
Floor finishes	37	16	3.97	3.75	4	4
Walling	36	17	3.91	3.82	4	4
Floor slab	37	16	3.83	3.93	4	4
Roof covering	37	17	3.81	3.76	3	4
Roof structures	37	16	3.78	3.81	3	4

Safety & security of the environment	36	15	3.77	4.26	4	4
Beam & columns	35	17	3.77	3.88	4	5
Internal partitions	36	17	3.75	3.94	4	5
Level of cleanliness	37	16	3.70	4.00	4	4
Air circulation	37	16	3.67	3.68	4	4
External painting	36	16	3.66	3.37	4	4
Ceiling	37	17	3.62	3.76	3	4
Windows	37	17	3.62	3.82	4	4
Doors	36	17	3.58	4.00	4	5
Solid waste disposal	37	17	3.56	3.35	4	4
Sanitary fittings	36	16	3.47	3.56	4	4
Refuse disposal	37	16	3.43	3.37	4	4
Internal painting	36	17	3.38	3.23	4	4
Water supply	37	16	3.35	3.62	4	4
Waste water disposal	37	15	3.24	3.53	4	4
Electricity supply(lighting)	37	16	3.24	3.00	4	4
Electrical appliances	37	17	3.08	3.23	4	4
Noise protection	34	16	3.05	3.12	3	3
Furnishing	37	16	3.05	3.31	3	4
Wall tiles	34	14	2.73	2.64	3	2
A/c or fan	26	15	2.53	2.73	3	3
Firefighting	37	15	2.48	3.00	3	2
Alarms & detectors	26	15	2.38	3.13	1	4
Telecommunication system	26	15	2.15	2.73	2	2
Netting	35	15	2.94	3.40	1	4

In relation to the mean item scores given above, the overall average (mean) of physical condition for users is 3.298 while that of maintenance officer is 3.456. It follows that maintenance officer perceived physical conditions of the prison to be in better condition than the state of the prison from the users' perspective. However, a correlation coefficient of 0.771 occurs between the two sets of response, implying a strong relationship

existing between the ratings given by the two categories of people in respect to the physical condition of prison in Nigeria.

Table 1.3 *paired sample t-test for comparison of prison physical condition for users and maintenance officers*

Mean	Std. dev.	Paired Differences		t	df	Significant level	Remarks
		Std error	95% confidence Interval of the Difference Lower Upper				
-0.158	0.357	0.064	0.289 -0.027	-2.464	30	0.020	significant

The t-test shows (table 3) a significant difference (0.158) for the mean score between User (3.298) and Officer (3.456); $t_{(30)} = -2.464$, $p < 0.05$. This outcome reveals a difference in the users and maintenance officer's perception of prison physical condition. It could be adjudged that even though the difference is negligible, might count a lot in some aspect.

3.3 Objective Two

To identify the factors affecting maintenance practices of prison buildings. Factors affecting maintenance practices of prison buildings are identified with the magnitude of their effect from the response of the users of the prison buildings and the maintenance officers in charge of the building maintenance. The following table shows the factors as identified by the users and the maintenance officers in order of their mean scores. For easy identification the factors are ranked according to the descending order of response given by maintenance officers.

Table 1.4 *Factors affecting maintenance practices of prison buildings.*

Factors	Number of officers	Number of users	Mean of officers	Mean of users	Mode of officers	Mode of users
Use of poor quality components & materials	16	34	3.87	2.82	4	3
Natural deterioration due to age of buildings	16	35	3.75	3.11	3	3
Non involvement of maintenance officers in pre & design stage	16	35	3.68	3.05	4	3
Absence of training & retraining of staff	17	35	3.58	2.97	4	2

Inadequate training & developments of personnel	17	35	3.58	3.45	4	3
Government preference in terms of budget allocation	16	35	3.56	3.22	4	3
Persistent breakdown of facilities due to indiscipline acts	17	36	3.52	3.16	4	3
Attitude of users	17	35	3.52	2.80	3	3
Complexity of design & non involvement of maintenance expert	16	33	3.50	2.51	4	2
Sequence of maintenance work not based on priorities	15	35	3.46	2.94	3	3
Decision on staff evaluation via recruit or training	15	35	3.46	3.05	5	3
Lack of motivation for maintenance staff	16	35	3.43	3.20	4	3
Level of knowledge of users in relation to building	17	35	3.41	3.31	4	3
Lack of comparative elements cost benefits analysis prior cause of repair	15	35	3.33	2.97	4	3
Insufficient fund for maintenance job	14	35	3.28	3.17	4	3
Irregular inspections	15	32	3.26	3.12	4	3
Mode of sharing budget allocation within department	16	35	3.25	3.22	3	4
Inappropriate use of facilities	16	36	3.25	3.38	3	3
Reluctance to innovative maintenance support	15	32	3.20	2.96	4	3
Buildability & maintainability study of design not being conducted before construction work	16	33	3.18	2.97	4	4
Management effort towards provision of resource for maintenance operations	16	35	3.18	3.42	4	3
Lack of skilled personnel maintenance unit	17	35	3.17	3.11	5	3
Inadequate plants & equipment for maintenance operations	15	35	3.13	3.28	2	3
No adoption of appropriate maintenance cycle for building maintenance	16	35	3.12	3.14	4	3
Lack of discernable maintenance culture	16	35	3.12	3.31	4	3
Poor workmanship	17	35	3.11	2.54	4	2
Materials & spare parts shortage due to poor inventory system	17	34	3.11	2.88	4	2
Lack of clear maintenance policy	14	35	3.07	2.85	1	2
Balancing limited prison resources with demand of maintaining prison buildings	16	35	3.06	3.02	4	3

Procuring & ordering of essential parts for replacement	16	35	2.94	3.42	3	3
High cost of maintenance by operatives	15	34	2.93	3.17	3	3
Lack of successful maintenance programme	15	35	2.93	3.02	4	3
Political influence on technical issues	15	35	2.86	3.28	3	3
Absence of a form of planned maintenance programme	15	35	2.86	3.17	3	3
Scarcity of building materials & spare parts	17	35	2.76	3.00	4	3

The first five factors identified by maintenance officers among other factors are; use of poor quality components & materials, natural deterioration due to age of building, non involvement of maintenance personnel in pre design and design stage, absence of training, retraining and continuing education of staff and, inadequate training and development of personnel. The users recognize inadequate training and development of personnel, quality of management of organization depicts the scale of effort towards the provision of resources for maintenance operations, no long term arrangement made for supply of essential parts for replacement, inappropriate use of facilities and level of knowledge of users in relation to building, as the first five factors affecting maintenance of prison building. The common factor between the two groups out of first five factors is inadequate training and development of personnel. However, the factors generally revolve around, material used for maintenance, maintenance staff and personnel's level of training and development. Furthermore, the users emphasized maintenance staff and personnel's level of training and development while the maintenance officers focused on material use for maintenance, as factor affecting maintenance management.

The maintenance officers ranked the 35 factors much higher in terms of their effects than the users with mean of 3.274 and 3.090 respectively. The analysis however, shows that no correlation exists between the two responses for the factors and their effects on the maintenance management of prison buildings.

Table 1.5 *paired sample t-test for comparison of factors affecting maintenance practices of prison buildings by users and maintenance officers*

Mean	Std. dev.	Std error	Paired Differences		t	df	Significant level	Remarks
			95% confidence Interval of the Difference Lower	Upper				
-0.184	0.377	0.064	-0.314	-0.055	-2.890	34	0.007	significant

The t-test given in table 9 shows that there is significant difference (-0.184) in the factors scores for users (3.090) and officers (3.274); $t_{34} = -2.890$, $p < 0.01$. This implies that response from maintenance officers is statistically different from the users' on the factors affecting maintenance management of prison building in the country.

4. Conclusion

The study revealed that the following are in good state as identified by the users; floor finishes, walling, floor slab, roof coverings, roof structures, safety & security of the environment, beams & columns, internal partitions, level of cleanliness, air circulation, external painting, ceiling, windows, doors and solid waste disposal while maintenance officers identified these components, safety & security of the environment, doors, level of cleanliness, internal partitions, floor slab, beams & columns, windows, walling, roof structures, roof coverings, ceiling, floor finishes, air circulation, water supply, sanitary fittings and waste water disposal to be in good order.

It can be deduced that generally, roof structures, roof coverings, ceiling, floor slab, floor finishes, walling, beams & columns, internal partitions, doors, windows, level of cleanliness, air circulation (ventilation) and safety & security of the environment are in good operational state in the Nigeria's prison while netting, firefighting equipment, telecommunication systems, and alarms & detector bad operational state. This indicates that whole components system of the prison buildings are not in good operational condition and this in a way affects the performance of the buildings especially where there is inadequacy in fire and communication services.

The factors identified by maintenance officers among other factors are use of poor quality components & materials, natural deterioration due to age of building, non involvement of maintenance personnel in pre design and design stage, absence of training, retraining and continuing education of staff. The users also identified inadequate training and development of personnel, management effort towards provision of resource for maintenance operations. The first common factor identified by the two groups is inadequate training and development of personnel. However, the factors generally revolve around, material used for maintenance, maintenance staff and personnel's level of training and development. Furthermore, the users emphasized maintenance staff and personnel's level of training and development while the maintenance officers focused on material use for maintenance, as factor affecting maintenance practices of prison buildings.

The t-test shows a significant difference (0.158) for the mean score between User (3.298) and Officer (3.456); $t_{(30)} = -2.464$, $p < 0.05$. This reveals a difference in the users and maintenance officer's perception of prison physical condition. Also, t-test shows that there is significant difference (-0.184) in the factors scores for users (3.090) and officers

(3.274); $t_{34} = -2.890$, $p < 0.01$. This implies that response from maintenance officers is statistically difference from the users' on the factors affecting maintenance practices of prison buildings.

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A Quantified Emerging Contractor Development Report: A Case Study in Pursuance of Best Practice

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ABSTRACT

Purpose

A quantified report has been compiled to reflect the outcomes of an emerging contractor development project. This case study contributes to achieving “best practice” development strategies.

Design/methodology/approach

This study was designed to give effect to governmental and other stakeholders’ requirements to provide successful contractor development processes. The methodology followed was to set development standards; design and implementation of measurement tools; the processing of data thus obtained; utilisation of the latter as part of total quality management procedures. This project took place over several years, having been concluded at the end of 2010.

Findings

The study found that measurement tools can be designed, producing data that can be utilized in total quality management procedures that improves the outcomes of emerging contractor development initiatives.

Research limitations/implications

This study was limited to the Eastern Cape Province, but the outcome, is nationally applicable.

Practical implications

A noteworthy contribution is made towards the pursuance of a “best practice” emerging contractor development model.

Originality/value

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This study is the most comprehensive quantified study available; that was conducted over an extended period. The resultant conclusions contribute to the enhancement of scientific development methodology.

Keywords: Best practice, Emerging contractors, Measurement tools, Quantified development

1. INTRODUCTION

In November 2007, the Eastern Cape Development Corporation (ECDC) launched a 24-month programme in order to support the development of emerging construction contractors in the Eastern Cape. The programme was a follow-up on a similar pilot programme that was launched between 2004 and 2006. This challenging decision was addressed by engaging the Built Environment Unit of the Council for Scientific and Industrial Research (CSIR), followed by the appointment of two consultants with unique skills in this field. The management team for the Integrated Emerging Contractor Development Model (IECDM) thus compiled, consisted of the following entities and persons:

- The ECDC, represented by Mr. Eugene Mfaka and Mr Mpumi Fundam with Ms Noludwe Ncokazi as the responsible executive.
- The CSIR, represented by Mr. Sihle Dlungwana as a Programme Leader, Mr. Theuns Knoetze as a Senior Manager and Mr Hans Ittman as an Executive Director.
- Noyana's Management Consultancy (Pty) Ltd, represented by Mr. Cannon Noyana.
- Construction Economic Associates (Pty) Ltd, represented by Prof Dries Hauptfleisch, a contract lecturer of the University of the Free State.

The initiative by ECDC was taken forward by developing an appropriate project structure, a project plan and scheduling a series of meetings to invite various stakeholders in the province to contribute to the programme success. This initiative was primarily driven by ECDC's mandate as a development agency.

Figure 1.1 outlines the major programme milestones from initiation at the end of 2007 until completion in 2010.

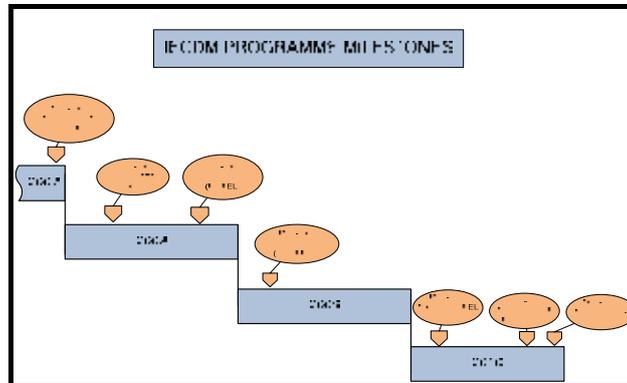


Figure 1.1 IECDM Programme Milestones

2. STRUCTURAL INTERVENTIONS

The following structural interventions have been made by government, and other organs of state, in order to create an “enabling environment” for the rapid development of, inter alia, construction contractors (summarised by Hauptfleisch, 2006:2-3). These interventions were discounted where possible in the development of the IECDM:

2.1 Construction Industry Development Board (CIDB)

The CIDB mandate is inter alia encapsulated in the following specific relevant abstract in the Construction Industry Development Board: Annual Report (2004/2005:12): “Promote sustainable growth of the construction industry and the sustainable participation of the emerging sector”.

2.2 Broad Based Black Economic Empowerment (BBBEE)

Government initiatives are further supported by the Broad Based Black Economic Empowerment Act (No 53 of 2003) (BBBEE, 2003:2) that is in the implementation phase.

2.3 Expanded Public Works Programme (EPWP)

The Expanded Public Works Programme (2005:2) inter alia states: “The emphasis of the EPWP is to expand the use of labour-intensive methods in government-funded service delivery projects to create more work opportunities and stimulate entrepreneurial activity.”

2.4 South African Construction Excellence Model

The CSIR has been involved in research work to develop the South African Construction Excellence Model (SACEM). Dlungwana and Rwelamila (2005:2-3) reported as follows: “The South African Construction Excellence Model (SACEM) is a business performance assessment tool developed to

3.1 Project Manager

As the IECDM is applied as a project within a project management programme (on a repetitive group basis) it is imperative that it should be managed as individual projects within an overall project management programme.

3.2 Client

Every project must firstly have a clearly identified client who is committed to the following:

The provision or facilitation of construction contracts for the contractors, valued up to R6.5 million for a period of at least 24 months.

Secondly, the client is required to make dedicated management inputs into the programme, provide an adequate budget for the programme.

3.3 Emerging Contractors

Contractors are subject to selection in order to enter the programme. The following criteria have to be met:

3.3.1 Assessment and recognition of previous learning (RPL) in order to select a suitable training package.

3.3.2 Must satisfy the minimum CETA requirements to enter a "learnership", leading to a national construction contractor qualification.

3.3.3 Must pass a potential test as part of the selection criteria.

3.3.4 Has to commit to the intensive 24-month training programme.

3.3.5 The above is partially based on the SACEM model

3.4 Accredited Construction Mentor

Mentors should be selected for the programme according specific relevant criteria, as having been trained in a specific discipline, does not assure the automatic ability to act as a mentor.

3.5 Construction Education and Training Authority

CETA as the statutory body providing funding for skills development are involved to fulfil its normal role as training authority, assessing outcomes of training and the awarding of qualifications.

3.6 Training Provider

The training provider has to be CETA accredited and should be carefully selected in order to assure that he is capable to provide the required training, working within a structured managed programme, contrary to the normal practice where training providers are only accountable to CETA. Emerging Contractors are trained in terms of the National Qualifications Framework (NQF) on Level 2.

3.7 Banks and other Financial Institutions

Banks have to be convinced to take part in the programme as they typically regard the emerging market as high risk and “not bankable”. Some banks are entering the market (cautiously) whilst some have responded favourably on tenders to serve this market under certain conditions.

3.8 Construction Industry Development Board

The CIDB adds the following value to the programme:

- 3.8.1 Construction industry “best practice” guidelines are general value add to the industry.
- 3.8.2 The introduction of a national “Register of Contractors” whereby all contractors are graded, provide benchmarks reflecting the ability of a contractor to undertake projects of a specific magnitude.

In its Status Quo Report (2009), the CIDB highlights as best practice the quality assurance processes of the CSIR/ECDC IECDM, listing, in particular, the programme’s mentorship approach.

3.9 Total Quality Management (TQM)

Independent total quality management has to take place throughout the programme. This function is executed on all the elements of the programme and reported to all concerned, typically in a statistical diagrammatic format.

3.10 Professional Services

A budget should exist in order to obtain specialised professional support for the programme when necessary.

4 SELECTION OF EMERGING CONTRACTORS, MENTORS AND TRAINING SERVICE PROVIDERS

4.1 Emerging Contractors

Emerging Contractors for the programme were selected from applicants who responded to a comprehensive advertising campaign in the Eastern Cape. The target was 60 contractors spread across 4 regions on the province. The selection criteria included:

- CIDB (or NHBRC) registration;
- Knowledge and experience of the construction industry, and
- BEE compliance (ownership).

The advert yielded 88 contractor responses but many of these contractors did not meet the selection criteria, particularly the CIDB registration criteria. The programme was launched with 67 contractors and 9 mentors, each mentor. The geographical spread of contractors was thus:

- East London: 11
- Port Elizabeth: 17

- Queenstown: 11
- Mthatha: 28

Due to budgetary constraints a decision was taken to begin the programme in September 2008 in Port Elizabeth and East London only. The programme for Queenstown and Mthatha started later in April 2009. It is important to note that the programme is based on the selection of a person and not on the bases of a specific business. Thus the focus is on individual persons to be empowered and not a fuzzy general business development approach. Forty eight contractors completed the programme, however, some did not complete all the prescribed course content.

4.2 Mentors

Since ECDC has a pool of accredited mentors in its database it was unnecessary to waste resources on province-wide adverts. Mentors for the programme were recruited by extending personal invitations for a briefing session where expression of interest was made by mentors.

4.3 Training Service Providers

Two CETA-accredited training service providers were sourced.

5 TOTAL QUALITY MANAGEMENT (TQM): METHODOLOGY AND APPLICATION OUTCOMES

5.1 Indabas and TQM Visits

In order to ensure that the required results were achieved a system of constant contact was put in place. TQM being a cornerstone of the IECDM dictated that the entire development process of the contractors had to be managed constantly. Two activities were introduced to achieve this. Firstly, workshops (called Indabas) were held in every centre, every three months, where all stakeholders were required to be present. One of the objectives of Indabas was to build teams that focussed on results. The other objective was to provide regular feedback on how the programme was faring by sharing information and experiences in order to provide effective learning. Secondly, during the period between Indabas the TQM team visited every mentor and the contractors assigned to that mentor in order to monitor the progress of each contractor. The purpose for such monitoring and evaluation visits was to ensure that capacity building was taking place, to agree on corrective measures where necessary and to generally manage the programme towards achieving the standards set.

5.2 Manual for Small Construction Contractors (MSCC)

To ensure that TQM takes place, clearly defined training standards and training material, should be available in a transparent, accessible and generic format. Under those conditions it will fulfil the very important role of being a readily available input during the process of setting standards, to be entrenched in the TQM work required. The management team has adapted

Master Builders South Africa's Manual for Smaller Builders into a Manual for Small Construction Contractors (MSCC), a fit for training and evaluation purpose.

5.3 Quantified Data: Mentor's Monthly Evaluation of Emerging Contractors

The MSCC was positioned to be a reference standard for the level of competency achieved by the contractors. The indexing of the manual was further used as reference for the monthly assessment made by mentors of each contractor's development level. Each knowledge area / core competency (as well as some others) contained in the index was taken up into a five-point assessment scale that was then assessed on a monthly basis by every mentor for every contractor. This provided the management team with a wealth of sensors (41) relating to every aspect of each contractor's development individually. The results obtained were translated into statistical data for each contractor, combined for every region and for the IECDM as a whole. The statistical data was then further processed and analysed through a computer programme, specifically designed for the IECDM, and presented in easily understandable diagrammatic presentations (see Section 6).

5.4 Quantified Data: Contractor's Evaluation of Mentors and others

The emerging contractors were also afforded the opportunity to evaluate the mentors and other role players on the programme. Their feedback, reflecting the actual experience of the beneficiaries of the programme, was very valuable as TQM input and provided very specific insights that were also used to assist with the management of the programme. It created an orderly platform for the contractors to put forward experiences and outcomes.

The results of the programme's evaluation by contractors, which amounts to an evaluation of contractors' satisfaction about the programme, is outlined in Section 8 of the report.

5.5 Business Development Programme

Although the contractors were subjected to the normal CETA evaluation procedures, the actual mechanics to establish the ability of contractors after having completed their formal training is suspect. The lessons learned in the past have clearly shown that the CETA procedures regarding the assessment of contractors have some deficiencies. The Business Development Programme tool is a structured mechanism used to supplement the formal training component by focussing mentoring on critical areas of contractor weakness.

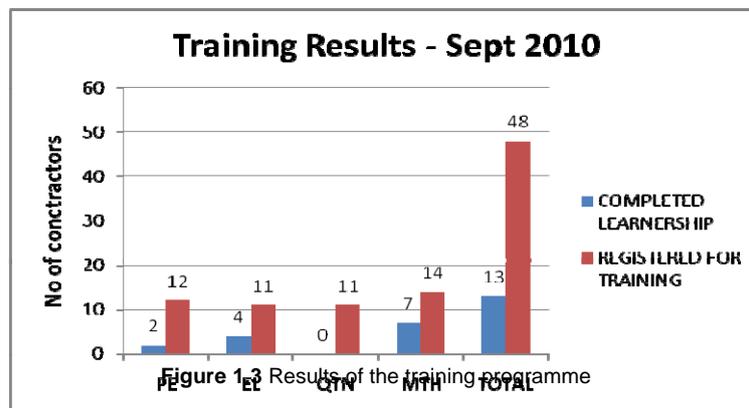
5.6 Descriptive Surveys and Application

Although the creation of quantified data was seen as a basic scientific methodology to obtain survey data from programme participants (mentors, contractors and CETA evaluations) it was supplemented by extensive qualitative data from stakeholders.

5.7 Status and Outcomes of Training

The training in Port Elizabeth and East London was concluded in September 2009 and training in Queenstown and Mthatha concluded in September 2010. Overall, training programmes in the IECDM programme have yielded poor results. Attendance levels have deteriorated drastically, especially in the year 2010. The reasons forwarded by contractors for this disturbing attendance levels have been many and varied, including lack of allowances to pay for travelling to classes, lack of time due to travelling to sites far from the class venues, ECDC's unfulfilled promises of work opportunities thus not seeing the value of training. Contractors who have not been able to complete all the unit standards by that programme completion date are unable to receive competence certificates.

Figure 1.3 illustrates the results of the training. Only thirteen of the forty eight contractors, who attended training, successfully completed all the modules within the allocated 18-month period. This translates to a 27% success rate of contractors that are eligible to receive the CETA qualification. Many contractors have a lot to answer in terms of their inability to attend classes regularly. Notwithstanding poor attendance levels, it was obvious that one of the two training providers had a dismal success rate, managing only 2 out of 23 passes. Questions also have to be asked about the adequacy of management on the part of the client as some recommended decisions were not implemented.



A disturbing aspect of the CETA component is that, throughout the programme, CETA was unable to provide ECDC with a Learnership Agreement for each of the contractors. The training was thus conducted and concluded, still waiting for the agreements. It remains an ongoing concern that CETA is unable to issue contractors with certificates of qualification in reasonable time.

6 ANALYSIS OF QUANTITATIVE DATA: MEASURING THE DEVELOPMENT OF SKILLS

All the quantitative data generated during the programme (as discussed above) was submitted to the CSIR's Logistics and Quantitative Methods Unit for capturing and statistical analysis. This element of the TQM process is unique and applied in order to continuously track, assess and manage programme outcomes (skill development) when embarking on the accelerated development of beneficiaries in a learn and earn environment.

Some sample graphical presentations of the processed data is presented in this section in graphical format, followed by abbreviated comments. The analysis shows a clear progress of construction skills formation for contractors over the implementation of the IECDM programme.

The most important outcome of the quantitative report is that it conclusively shows that it is possible to set standards for all aspects of a development programme, measure the outcomes, assess deviations and take corrective steps, based on the measured outcomes, during the life of a programme.

Figure 1.4 shows the average performance of contractors per region. East London exhibited the highest average scores followed by Port Elizabeth, Queenstown and Mthatha.

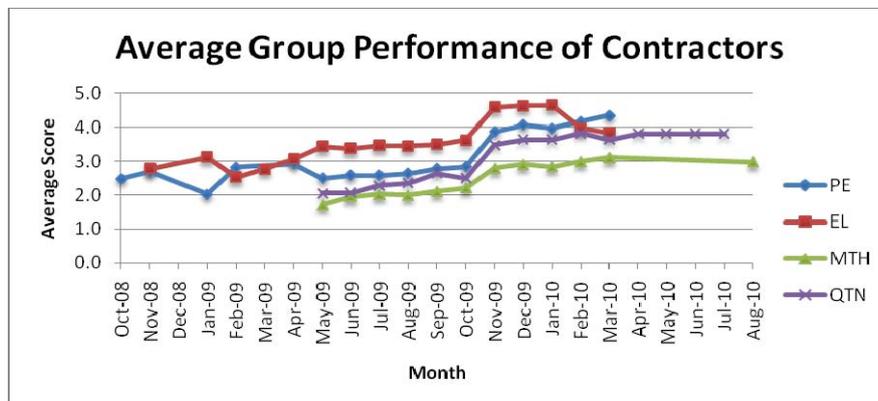


Figure 1.4 Average performance of contractors by region

Figure 1.5 displays the overall performance of contractors on the programme across all regions. The number of months for which the contractors were on the programme was used in analysing the overall performance of the contractors instead of calendar month. This was done because the programme started in different months in each of the regions

under consideration and in order to determine the average performance of the contractors over time, these starting periods needed to be aligned.

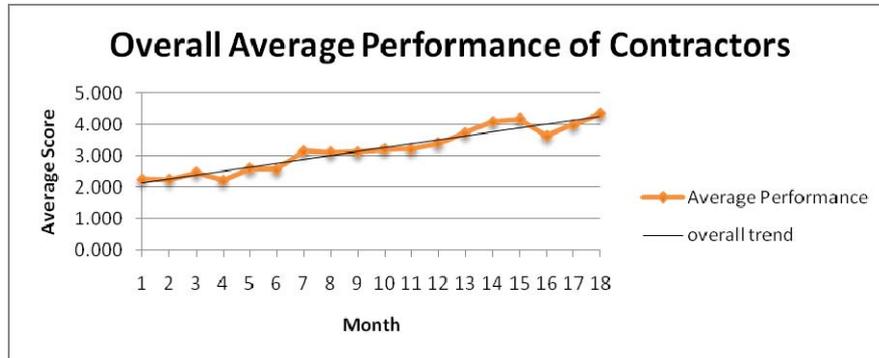


Figure 1.5 Overall average performance of contractors over time

Figure 1.6 shows average performance of contractors assigned to each mentor. Only the number of months which the contractors were on the programme was taken into account in performing the analysis for each of the mentors. This was done to make the comparison of the performance of the contractors under each mentor easier.

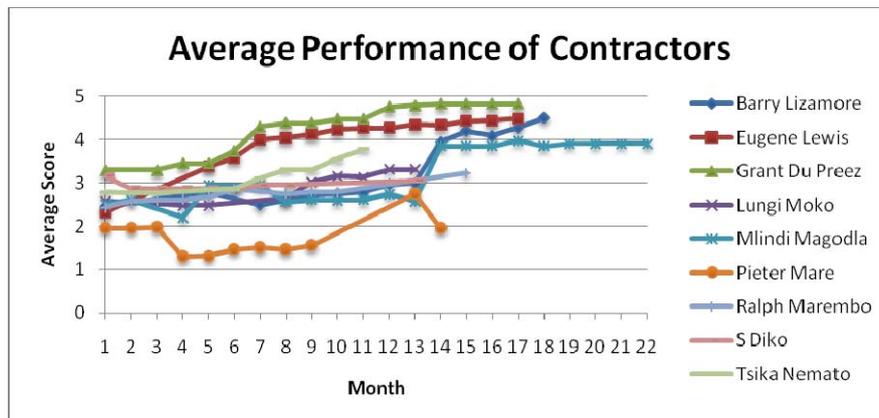


Figure 1.6 Average performance of contractors by mentor

Figure 1.7 (a and b) outlines the average score of some performance indicators used per region. Many others have also been generated.

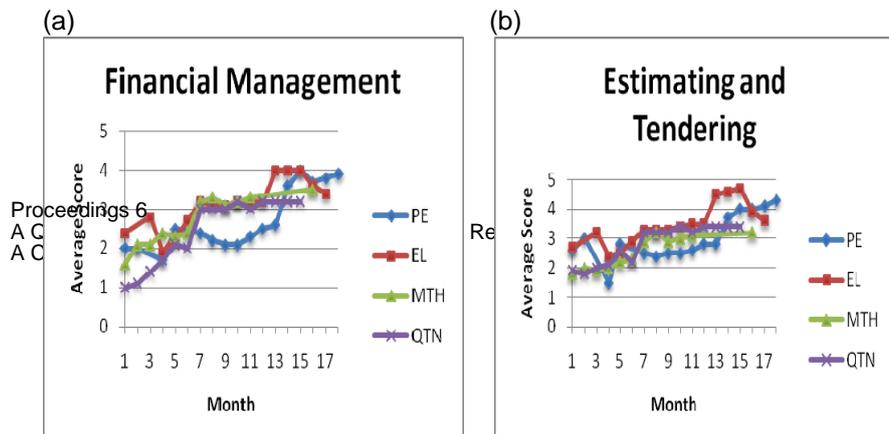


Figure 1.7 Average score by performance indicator per region

7 ANALYSIS OF QUALITATIVE DATA: IMPACT OF THE IECDM PROGRAMME

This section outlines two surveys that were conducted on contractors. The first survey was conducted to gauge contractors' views on the mentorship process and the usefulness of various role players. The second survey was for assessing the impact of the IECDM programme on contractors businesses. Both surveys were conducted as a supplementary exercise to the quantitative exercise during the programme, as outlined above.

7.1 Survey on the mentorship process and roles of role players

In September 2010, upon completion of the programme, a brief survey was conducted among some of the contractors.

There was generally above average satisfaction with mentors, trainers, CSIR and quality assurers. On average mentors scored much higher than the training providers. The remarks for mentorship support carried a lot of positive sentiments compared to the remarks for training support.

7.2 Survey on the impact of the IECDM Programme

Structured interviews were conducted with contractors by telephone between the 7th of December 2010 and 13th December 2010 in order to determine the impact of the IECDM programme. Thirty four (34) contractors across all the regions representing a sample size of 67% were interviewed. The objective of the survey was to assess the impact of the programme from the perspective of the contractors. The results of the survey are described below.

Improvement of business management skills

- Ninety four percent of contractors felt they have improved their ability to manage their businesses since they joined the IECDM programme (an average rating = 3.38 out of 5 was given).
- Ninety seven percent felt they are now able to execute larger projects (rating = 3.44).

Improvement of tendering skills

- Ninety four percent felt the programme has helped them improve their ability to tender (rating = 3.5).

Business growth and CIDB Upgrading

- Seventy four percent said their business has experienced some growth since the programme joining the programme (rating 3.0).
- Despite 74% experiencing business growth, only 32% have upgraded their CIDB grading, citing lack of work as the reason. It seems that while many contractors have experienced some business growth, this is not significant enough to reach the next CIDB grade.

Increased employment

- Seventy one percent of the contractors reported that their staff has grown and 62% reported turnover growth during the course of the programme. The figure of 62% turnover growth is substantially less than the 74% who reportedly were experiencing business growth; this seems to be an inconsistent statement by contractors. While it was not possible to quantify how many jobs were created by the programme, it is clear there has been good increase in employment by most contractors.

The surveys indicate that the programme has had a very positive impact on the contractors' businesses.

8 ANALYSIS OF PROJECT SUCCESS AND SHORTCOMINGS

Experimental developments of the model have lead to the identification of the following successes and failures for the overall programme:

8.1 IECDM

8.1.1 Successes

- The IECDM as a developmental tool has proven to be effective in developing emerging contractors.
- The programme achieved its objective of leading a holistic approach towards integrated skills development for emerging construction contractors, leading to a model that can be managed with quantitative and measurable outcomes.
- Introduction of TQM and BDP has lead to improved performance by the emerging contractors.
- Despite many challenges experienced by the programme, many contractors have given very positive feedback of the programme.

8.1.2 Failures

- The programme management structure comprising CSIR project manager, ECDC project manager was not clear on some aspects of managing the service providers due to the fact that other aspects of management, e.g. invoice payments and contracting, was administered by ECDC. It was a failure by ECDC and CSIR not to address these aspects of project administration.
- The process of selecting contractors must be reviewed as reflected in the results of the close-out questionnaire.
- The client experienced a prolonged internal staffing dispute which severely affected the smooth running of the programme. These matters were probably not easy to resolve but they contributed very negatively to the progress of the programme, causing much delays to

the programme operations and neglect of many recommended actions.

8.2 Mentors

8.2.1 Successes

- TQM revealed that the mentors played a key role in the development of the emerging contractors.
- A fully fledged mentor practice procedure has evolved out of the IECDM.
- The implementation of the mentor guideline document has resulted in the mentor / contractor relationship improving. This reflected in the emerging contractors improved performances.

8.2.2 Failures

- A mentor was found to be neglecting her duties – she subsequently ‘resigned’ verbally. The client representative did not implement the necessary contractual procedures to address the problem. It was therefore a project failure by the client not to implement proper disciplinary measures.

8.3 Emerging Contractors

8.3.1 Successes

- As per the results obtained, the emerging contractors have benefited from the participation in the IECDM programme.
- The results indicate that the IECDM has achieved its objectives as the beneficiaries of the programme have indicated a high degree of satisfaction with the IECDM as a result of improved business capacity and growth as well as a new found confidence in the construction industry.

8.3.2 Failures

- The mentors and training providers indicated that the selection of contractors for the IECDM needed improvement, although not regarded as a total failure; the IECDM client should review the selection process in accordance with the information provided by the mentors and training providers.
- Once the contractor (person) has been selected, there should be strict adherence in terms of who benefits from the programme. There has been instances where selected people sent their representatives to attend classes.

8.4 Training Providers

8.4.1 Successes

- The training providers had varied success, with certain providers more efficient than others, requiring continuous managerial intervention. Although problems were experienced during the programme, the emerging contractors scored them highly at conclusion.

8.4.2 Failures

- The training providers selected were provided by CETA and listed as accredited training providers on the CETA database. The project team's failure was to assume that the training providers had the necessary competencies to teach the NQF level 2 Learnership effectively.
- Both training providers used their own training material and methods of training, thus there were three differing methodologies, proving very difficult to manage.
- It was taken for granted that CETA's internal quality assurance mechanisms would provide guidance in the training methodology of the training providers, but that did not materialise.
- Training providers are in a position according to CETA to declare whether contractors are competent or not with regard to the various unit standards of the Learnership. Yet contrary to that, the mentors found that the emerging contractors still lacked the ability to perform some tasks (in which they were found to be competent by training providers) when it came to practical application.

8.5 TQM Consultants (Quality assurers)

8.5.1 Successes

- The quality assurers performed the duties effectively as reflected by the results.
- The experience of the quality assurers allowed for effective management of the mentor/contractor relationships.
- The quality assurers were able to identify and address conflicts during their sessions.

8.5.2 Failures

- Many of the recommendations brought to the client's attention by the quality assurers were unfortunately not implemented. Consequently, many problems were not resolved, thus robbing the programme of potentially better end-results.

8.6 CETA NQF Level 2 Learnership

8.6.1 Successes

- The Learnership serves as a viable theoretical base for the emerging contractors.
- The content and scope covers the required basic elements of construction.

8.6.2 Failures

- The Learnership, in particular, requires improvement of the tendering and financial modules. TQM revealed that emerging contractors required more detailed training, particularly regarding tendering, as it remained a key area of weakness on the programme.
- Despite many calls to CETA for assistance, CETA was not visible and did not react to address the needs of the programme.

9 CONCLUSIONS

In order to create an enabling environment for contractor development the IECDM should contain the following elements, which are essential towards sustainable contractor development, following a holistic integrated approach amongst the implementing agents and programme stakeholders:

- The IECDM requires that a local, regional or national body, with sufficient muscle, undertake the programme. Economy of scale is achieved by implementing a comprehensive programme across a region such as a province. Integrated programmes are remarkably cost effective when conducted on a fairly big scale. Typically organisations such as government departments (Department of Public Works and Housing), metros, and development corporations are ideal promoters for the model.
- An important principle of a development programme is recognition that it is a training programme with the objective of creating a sustainable construction business. Training has a price tag and satisfactory results are achieved more effectively and efficiently when programmes have the necessary financial resources and the full commitment of all stakeholders.
- The programme has to be rigorously managed. This requires that a competent project manager and management team be appointed to manage the programme on a day-to-day basis.
- The client body has to commit a dedicated project champion to the programme.
- All elements of the programme have to be quality assured and managed each step of the way so that corrective action is taken timely. This is done by way of the programme initiator receiving regular progress reports, based primarily on quantitative data, supported by qualitative data.
- Selection criteria should be further developed and applied to identify and select suitable contractors who will enter the programme.
- All participating contractors have to undergo a Learnership such as the CETA NQF Level 2: Construction Contractor. Where appropriate, implementing authorities may wish to adjust certain aspects of a Learnership Agreement. A recognition of prior learning (RPL) intervention may also be required. It is important to select training providers who have experience in the construction industry and are prepared to commit whole heartedly to an integrated programme, becoming team members and not only hit and run training providers.
- The IECDM is mentor-based and the appointment of an accredited mentor (based on construction knowledge and aptitude) is central to the success of the programme. The University of the Free State has such an accreditation programme, now in the process of being adopted by SACPCMP.
- Contractors are developed successfully when they have continuous construction work. If possible, contractors on the programme should be provided with term contracts for a minimum period of 24 months. This time scale also synchronises with CETA Learnership requirements.

- Financial packages should be obtained from financial institutions that are committed to the programme and the development of contractors. The nature of the programme offers security to a bank that it cannot normally obtain from a contractor on his own. Although commercial banks were not formally introduced as direct stakeholders, many contractors have secured facilities and cheque accounts from them.
- It is noteworthy, that even with some contractors not having completed all facets of the programme, clear competency development is still achieved by all.

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Modelling PhD (Construction Management) research findings: lessons from SD

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ABSTRACT

Purpose: Research output at the doctoral level is often inclusive of models, which normally propose solutions to problems in line with the system thinking approach that is reportedly a smaller version of what constitute system dynamics (Forrester, 2007: 355). Therefore, in order to ensure usefulness of models in practice, this paper aims to argue that system dynamics (SD) offers robust ways of modelling empirical research output.

Design / Methodology / Approach: The paper relies upon a review of project dynamics related literature. In this context, construction models are models developed through the SD methodology documented in Sterman (2000: 83-106).

Findings: Through project dynamics structures, SD models have become useful in the construction management domain especially with respect to problems such as poor performance. While issues relative to performance are multi-faceted, SD models have progressively impacted the practice of construction management significantly.

Practical implications: Model development and validation (testing) is presented with a view of stimulating interest in SD since SD applications in the project management domain have proven to be successful when

measured in terms of number of applications, value of consulting revenues, and value to the client (Lyneis and Ford, 2007: 157).

Originality / Value: SD modelling entails qualitative, quantitative, and simulation undertakings that are useful and valuable through their robustness within the South African construction context.

KEYWORDS: Construction Management, Models, Research, System dynamics

1.0 BACKGROUND

Lots of project models are system dynamics-like, but if the research work is not done through the system dynamics modelling methodology lens, that is, if the work failed to use feedback, accumulation, non-linear relationships to explain how structure and behaviour interact, then the work has not fully applied the system dynamics methodology to project management (Ford, 2007).

According to the June 2007 “SD Project Management Bibliography” compiled by David Ford, SD is presently gaining ground in construction project related research endeavours with respect to various phenomena such as quality, rework, project strategy, project dynamics, litigation, project performance, contingency management, constructability reviews, uncertainty, risks, cost overruns, schedule overruns, concurrent project development, delay, nature of project leaderships, change management, iterative error and change circle, resource allocation, reliability buffering as well as planning and control (Ford, 2007). Though, authored by people with different academic and professional background, the bibliography however points to the undeniable fact that SD offers significant opportunity for resolving construction project related problems.

It is also notable that all publications listed in the bibliography were done through the SD methodology lens as described in Forrester (1961) and Sterman (2000). Specifically, Sterman (2000) contend that SD which is partly a method for developing management flight simulators in the form of simulation models, is a method to enhance learning in complex systems. He emphasized that SD models are developed to enhance learning about complex systems, understand the sources of policy resistance, and also to facilitate the design of more effective policies. Therefore, SD is reportedly fundamentally interdisciplinary in nature since it is not only concerned with the behaviour of complex systems, but also grounded in the theory of non-linear dynamics and feedback control developed in mathematics, physics, and engineering related fields. In addition, Sterman (2000) suggest that because SD tools are applied to the study of behaviours of human, physical, and technical systems, it draws on cognitive and social psychology, economics, and other social sciences.

Thus the explanations about “what SD is” seem to suggest that SD though related to system thinking, is much more than system thinking. System thinking is mainly a discipline for seeing wholes rather than snapshots, that is, it is a framework for seeing interrelationships rather than

things, for seeing patterns of change rather than static snapshots (Senge, 2005). It is the ability to see the world as a complex system in which we understand that “you can’t just do one thing” and that “everything is connected to everything else.” (Sterman, 2000). Therefore, regardless of the adopted research perspectives, the construction management research that is regarded as an applied field of investigation that is seemingly rooted in the positivist tradition (Dainty, 2008) should embrace concepts, which may aid in engendering continuous improvement in the construction process (Fellows, 2010). In brief, system thinking and SD holds useful opportunities for the advancement of decision-making and policies central to the project management domain in general, and South African construction in particular (Taylor, 2010).

1.1 HISTORICAL BACKGROUND OF SYSTEM DYNAMICS

After an exemplary career in engineering, Jay W. Forrester created a new field called ‘industrial dynamics’ at M.I.T’s Alfred P. Sloan School of Management between 1957 and 1958 (Sterman, 2007; Roberts, 2007). Jay W. Forrester’s unique contribution to the new field was to develop ideas about feedback systems, and their dynamics into a rigorous yet practical method for ‘enterprise design’, which translated to a method that was designed to find management policies and organisational structures that can lead to greater success by reducing or eliminating important top management problems (Forrester, 1961; Sterman, 2007).

This new field, which was subsequently renamed ‘System Dynamics’ (Roberts, 2007) is grounded in control theory and nonlinear dynamics that involved both qualitative and quantitative approach, hard and soft approach, and a theoretical as well as pragmatic approach for model development and policy design (Sterman, 2007). For example, books authored by Jay W. Forrester (Industrial Dynamics published in 1961; Urban Dynamics published in 1969; and World Dynamics published in 1971) and John D. Sterman (Business Dynamics published in 2000) individually and collectively demonstrate key concepts of SD, including feedback, counterintuitive behaviour, limits to growth, nonlinearity, tipping points, and many others concepts that are now completely integrated into management discourse and social theory in North America and Europe. Specifically, Industrial Dynamics introduced a system perspective to industrial management discourse (Forrester, 1961), Urban Dynamics (Forrester, 1969) drew attention to the contradictions in low cost housing policy that was being implemented particularly within the black community in inner cities of the USA, and World Dynamics (Forrester, 1971) addressed factors affecting the quality of life and the dynamism of population.

In addition, the world’s first PhD dissertation in SD authored by Edward B. Roberts in 1962 was a large-scale model of the life cycle of a research and development (R&D) project, which addressed interactions between a sponsoring customer and a performing organisation with the overall aim of modelling the economic system between both parties (Roberts, 2007). It is notable that the dissertation that was later published in 1964 as ‘The Dynamics of Research and Development’ made use of

extensive academic literature and empirical studies in the R&D domain. To be succinct, SD has been applied and will continue to be applied to problems relative to corporate growth and stagnation; the diffusion of new technologies; business cycles; speculative bubbles; the use and reliability of forecasts; the design of supply chains in business and other organisations; service quality management; transportation policy and traffic congestion; product development, and project management (Sterman, 2000).

However, underpinning the application of SD to these issues is the competence relative to the use of simulation software such as STELLA, Powersim, iThink, DYNAMO, VENSIM (Sterman, 2000; Jackson, 2003; Forrester, 2007). Any one of this user friendly software allows conversion of causal loop and 'stock and flow' diagrams into sophisticated computer simulations that facilitates the creation of micro worlds otherwise called management flight simulators (Jackson, 2003; Forrester, 2007). These management flight simulators present managers with an easily understood control panel that hides a gaming environment, which allow managers to try out various decision rules relative to situations they are facing at work, and also see what consequences may ensue. It is instructive to note that while management games focus on decision-making, SD emphasise the design of policies for guiding decisions (Forrester, 2007). This suggests that system thinking that encourages people to believe the existence of systems is perhaps 5% of the way into understanding systems, while the other 95% lies in SD structuring of models and simulations (Forrester, 2007). Therefore, system thinking that is seemingly in the majority in construction management research especially at the PhD level can be a first step toward a dynamic understanding of complex problems. Therefore, in SD model development undertakings, implementation and achievement of change with realistic data is strongly advocated (Roberts, 2007). Being an applied field of research enquiry, it is argued here that SD offers opportunities for addressing numerous construction management related problems with respect to strategic as well as operational management of projects.

With increasing acknowledgment that a project is more than just the sum of its individual processes, simulation focus has been broadened from the 'operational level' to the 'project level' in order to completely understand project behaviour (Shi, 2001 cited by Han, 2008). Combined with this necessity and the limitations of other modelling methods instigated the introduction of control theory based SD into the construction management domain because of SD ability to effectively capture feedback (Lyneis *et al.*, 2001; Lee *et al.*, 2006).

Therefore, measured in terms of new SD theory, new and improved model structures, number of applications, number of practitioners, value of consulting revenues, and value to clients, 'project dynamics' stands as an example of success of SD in action since project conditions and performance evolve over time as a result of feedback responses involving nonlinear relationships, and accumulations of project progress and resources (Lyneis and Ford, 2007). Consequently, in terms of project models structures, project features, the rework cycle, project control, and the ripple and knock-on effects dominate the literature (Lyneis and Ford, 2007).

2.1 Project Features

Lyneis and Ford (2007) contend that SD project models focuses on development processes, resources, managerial mental models, and decision making. Modelling these important components of actual projects therefore increases the ability to simulate realistic project dynamics and relate directly to the experiences of practitioners. In addition, their study reveal that a principal feature of all SD project models is the representation of development tasks (work packages) as they flow through a project. These tasks typically start in a stock of 'tasks to be done' and then flow through the projects development processes until the stock of 'tasks done' reaches the level of project completion.

Another important feature of project represented in SD models is the application of resources to manage the flows in the development process, based on managements' perceptions of project conditions. For instance the first published model of a project introduced the flows of project work in terms of 'job units' based on resources applied and productivity gained (Roberts, 1964 cited by Lyneis and Ford, 2007). The publication introduced several important concepts that represented management's understanding of project conditions with respect to perceived performance gaps, that is, differences between perceived progress and actual progress and between perceived productivity and actual productivity; and also underestimation of project scope and effort required for project realisation. These errors can lead to poor allocation of resources that eventually feed back to impact project performance (Lyneis and Ford, 2007). Further, recent SD research publications have continued to address the human aspects of project management such as the use of contingency funds (Ford, 2002: 34), schedule buffers in construction projects (Park and Pena-Mora, 2004: 630), and resource allocation policies for reducing project durations (Lee *et al.*, 2007: 557). Incontrovertibly, these features clearly exploit the ability of SD to model human decision making such as modelling decisions driven by performance gaps, delay in human processes, and nonlinear relationships (Lyneis and Ford, 2007: 160).

To be succinct, as indicated in Figure 1 and to a limited extent on Figure 2, the primary focus of SD modelling is to identify the feedback structure, analyse cause and effect relationships between variables (qualitative modelling), and mathematically formulate the identified feedback structure with the use of stock and flow concepts (quantitative modelling); and then utilised the developed SD model to identify root causes of poor project performance, and thereafter postulate effective policy that can improve the performance by re-organising the internal feedback structure (Han, 2008).

The rework cycles refers to a set of canonical structures that drive much of the dynamics of specific model types (Lyneis and Ford, 2007). The inventory-WIP structure in supply lines is an example of the rework cycle (Sterman, 2000). Lyneis and Ford (2007) suggest that the rework cycle is the most important feature of SD project models because of its recursive nature, which enable its iterations to pervade the entire project duration with the attendant behavioural problems. The analogy behind the rework cycle and its associated building blocks (productivity, quality) as indicated

in Figure 1, is its tendency to become pervasive in a project, and the high level of commonality associated with its existence in a wide variety of projects (Cooper *et al.*, 2002).

Therefore, these attributes evidently warrant the amount of research publications that have attempted to shed more light on the phenomenon referred to as 'the rework cycle'. For example, Park and Pena-Mora (2003) elaborate on the flows and differential between rework that occurred in order to correct flawed work (defect) and rework that occurred due to an externally generated change order. The importance of the rework cycle is underscored by the fact that virtually all SD project models since the 1980 publication of the original rework cycle have included a rework cycle (Lyneis and Ford, 2007).

2.2. The rework cycle

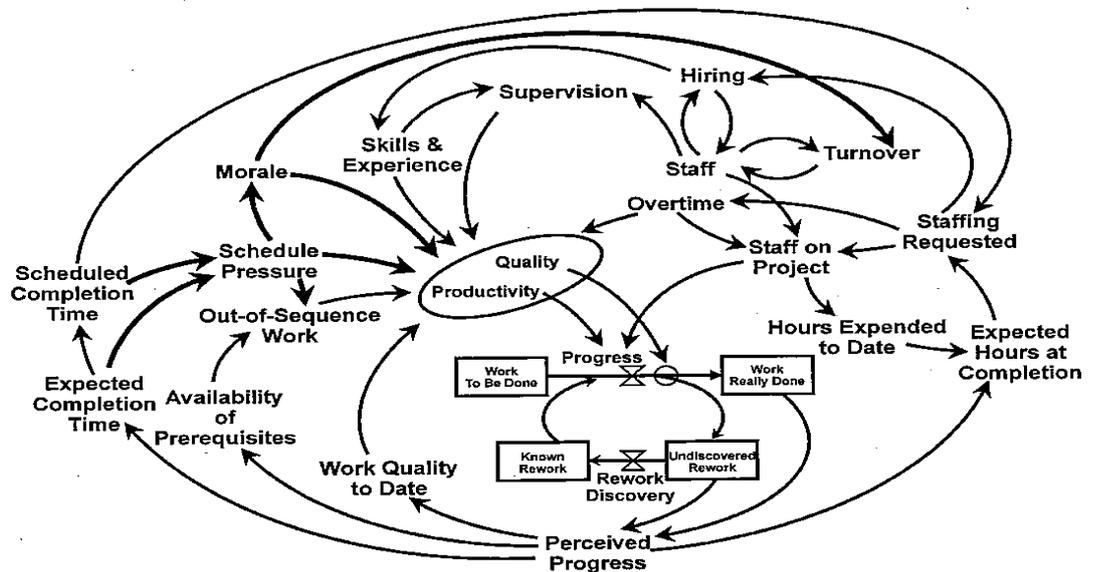


Figure 1 The rework cycle Feedback effects (source: Cooper *et al.*, 2002: 215).

2.3 Project control

The primary objective of applying SD in many domains is to model, analyse and improve the control of dynamics systems. Therefore, since the primary objective of construction project management is to deliver projects within stated cost, time, quality, and other performance parameters, modelling the controlling feedback loops through which management attempts to close performance gaps is almost the same as applying the foundation of SD to project management (Lyneis and Ford, 2007). In controlling the feedback

therefore, SD researchers have focused on the information processing of project managers.

Realising limitations associated with traditional method of project control (overtime work and slip a deadline), SD models have consistently modelled perceived conditions separately from actual conditions, with the former driving project control actions and the latter driving actual progress (Lyneis and Ford, 2007). Specifically, Lyneis *et al.*, (2001) suggest that the tendency for project managers to view a project statically or narrowly result in continued mistakes and failure to learn from past experience that are always exhibited in consistent overestimations relative to progress and productivity of projects. Consequentially, SD models have attempted to remedy the situation by simulating three project control options namely 'hire additional workforce (Add People)', 'work overtime (Work More)', and 'work faster (Work Faster / Slack Off)'. In these loops, an expected completion delay that is indicated by more time required to finish the work remaining than the time remaining to the project deadline initiates hiring, overtime, higher intensity of work, or a combination (Lyneis and Ford, 2007). In generic terms, the SD models are based on the premise that dynamic complexity arises because systems are dynamic, tightly coupled, governed by feedback, nonlinear, history-dependent, self-organising, adaptive, counterintuitive, policy resistant, and characterised by trade-offs (Sterman, 2000).

2.4 Ripple and Knock-on Effects

Actions that are intended to control projects by closing the gap between project performance and targets often generate side effects in the form of policy resistance. These effects typically reduce productivity, and possibly also reduce quality in projects at the same time (Lyneis and Ford, 2007). In addition, 'knock on' relationships can generate significant harmful dynamics, which include (Lyneis and Ford, 2007):

- 'Haste creates out-of-sequence work', that is, trying to accomplish more tasks in parallel than physical or information constraints allow, whether by adding resources or exerting schedule pressure can cause work to be done out of initial sequences. This situation reduces productivity, and increase errors at the same time (Lyneis *et al.*, 2001; Ford and Sterman, 2003).
- 'Error builds errors', that is, undiscovered errors in upstream work products (design) that are inherited by downstream project phases (construction) reduce the quality of downstream work as these undiscovered problems are built into downstream work products. Lyneis *et al.*, (2001) present a typical case example.
- 'Errors create more work', that is, the process of correcting errors can increase the number of tasks that need to be done in order to fix the problem, or can increase the work required because fixing the error takes more effort than doing the original work. The 'tipping point' dynamics, which is a demonstration of this feedback process,

indicates that if these processes are not managed properly, project failure may occur (Taylor and Ford, 2006).

- “Hopelessness”, that is, morale problems can exacerbate the effects in the form of fatigue, and also rework can create a sense of “hopelessness” that increases errors and reduces productivity.

However, Lyneis and Ford (2007) contend that though the primary adverse ripple and knock-on feedback as typically modelled by SD researchers are internal to the project, adverse feedbacks through clients and customers may initiate and amplify internal project dynamics. Examples of these external actions include (Lyneis and Ford, 2007):

- Clients often change scope or requirements, activating project control actions, ripple effects, and knock-on effects, thereby degrading projects that were otherwise successful;
- Projects which are under budgeted can lead to efforts by the contractor to increase the budget through change orders, which divert efforts from other project work;
- Poor schedule performance and slipping of deadlines can reduce client trust in the project team, with the resultant demand for more progress reports; more time spent on progress reporting and interacting with the client reduces productivity, slows progress and necessitates additional schedule slip through a reinforcing loop;
- Reduced client trust can also lead to reluctance by the client to tolerate further deadline slippage, which increase schedule pressure and aggravate project control problems, and
- In the extreme, if project problems lead to litigation while the project is still on-going, then diversion of management attention to litigation activities can reduce attention to the project itself, and thereby exacerbate project performance.

In simple terms, in order to avoid policy resistance and find high leverage policies therefore requires the expansion of the boundaries of mental models so that awareness and understandings relative to the implications of the feedback created by policy decisions can be engendered, that is, learning must include the structure and dynamics of the increasingly complex systems in which policy decisions are embedded (Sterman, 2000).

3.0 System Dynamics Applied to Construction Project Management

With the increasing acknowledgement that a project is more than just the sum of its separate processes, researchers have proposed the extension of simulation focus from the 'operation level' to the 'project level' in order to adequately understand project behaviour as actual applications of simulation results reported significant improvement in construction productivity (Shi, 2002). Coupled with this reason and the reported limitation of Discrete Event Approach (DES), SD was therefore introduced into the construction management domain because of its ability to effectively capture feedback (Lyneis *et al.*, 2001; Lee *et al.*, 2006). The key idea behind SD is based on the assumption that the majority of the complex dynamics arise from the feedback among the various components of the system, and not from the complexities of the components themselves (Sterman, 2000).

In other words, SD's emphasis on the system structure (the feedback process) bolsters the understanding of the system (Han, 2008). Using an illustration, Han (2008) contends the primary focus of SD modelling is to identify the feedback structure, analyse cause and effect relationships between variables (qualitative modelling), and then, in order to mathematically formulate the identified feedback structure, SD uses the concept of stock and flow (quantitative modelling). Developed through these steps, SD models are utilised to identify root causes which lower project performance, and also find an effective policy that can improve the project performance by re-designing the internal feedback structure (Han, 2008).

Therefore, since the commonest behaviour of actual projects cited in the literature is failure to achieve performance targets (Lyneis *et al.*, 2001), most SD models have used the aforementioned project structures and methodology to explain these failures and suggest improvements (Lyneis and Ford, 2007). In fact Lyneis and Ford (2007) contends that research and application in project dynamics have focused on understanding the drivers of cost and schedule overrun in particular situations, and then on developing actions that either avoid or minimise the overruns, or on obtaining compensation for the additional costs. They say while there are some overlaps, the research and applications addressed general project management areas such as post-mortem assessments for disputes and learning; project estimating and risk assessment; change management, risk management, and project control; and management training and education. For the purpose of this particular discourse, explanations are limited to post-mortem assessments for disputes and learning; project estimating and risk assessment; and change management, risk management, and project control.

3.1 Post-Mortem Assessments for Disputes and Learning

Quite a number of SD applications in the project management domain involve post-project assessment of what happened, that is, how did the project deviate from the initial plan and why did the deviation occur? These questions mostly involve clients and contractors that worked together on

particular projects. However, post-project assessments involve attempts to learn from one project to the next within an organisation.

Lyneis and Ford (2007) suggest that in its application to disputes, SD models are used to quantify and explain the impact of direct changes to final project cost. A model can be set up to represent the project as it actually occurred, including the direct impacts, and calibrated to the actual performance of the project. Then client-responsible direct impacts are removed and the model re-simulated to determine what would have happened without the disruptive actions of the client. The difference between the historical and 'would have' simulations is the full cost of the client actions, including ripple and knock-on effects. Thus SD can apportion costs to the client, to other parties, and to the contractor through simulations removing different groups of direct impacts. In fact significant number of SD applications to project dynamics are related to delay and disruption disputes (Eden et al., 2000; Howick, 2003) with Pugh-Roberts & Associates (PRA) having done more than 45 such projects as at 2005 (Stephens *et al.*, 2005).

Similarly, in project-to-project learning the modelling process is set up to represent what actually happened on the project, including the direct impact of any changes that occurred on the project. The direct impacts of these changes are removed as inputs to the simulation, one at a time, to identify their contribution to any project overrun. In this way, project managers can learn which changes had the greatest impact on the project, and thereby identify risks that should be addressed in future project (Lyneis and Ford, 2007).

3.2 Project Estimating and Risk Assessment

Empirical evidence suggest that, in addition to unanticipated changes to the plan, another common trigger for adverse project dynamics is underestimating work scope or under-budgeting for the estimated work scope (Flyvberg *et al.*, 2003). While post-project evaluations are essential for understanding what happened, their greatest value may be in improving project estimating and risk assessment, that is, evolving a way of developing project budgets and plans that are more realistic and robust is the main thrust of a post-project review (Lyneis and Ford, 2007). For instance, projects that are underestimated end up costing more because of the adverse ripple effect dynamics incurred once the underestimate is discovered.

In addition, SD has been used for risk assessment with respect to post-project evaluations that determines the magnitude of changes that actually occurred on projects as a guide for what may occur on future projects, and pre-project simulation test that attempt to highlight the consequences of similar risks for current project undertakings (Lyneis and Ford, 2007).

3.3 Change Management, Risk Management, and Project Control

Lyneis and Ford (2007) contend that an SD model can provide valuable input into decisions relative to change management, risk management, and project control by taking into consideration feedback in projects, especially the adverse ripple effects of management actions. For example, with respect to change management, Cooper and Reichelt (2004) demonstrate that the full consequences of changes and their associated cost, including ripple effects, increases non-linearly with the cumulative size of all changes, and as the changes occur later in the project.

Further examples of applications of SD to change management include Fluor Corporation's (a global engineering, procurement and construction (EPC) contractor) proactive use of project models to forecast and mitigate change impacts, including quantifying the effects of the changes, diagnosing the causes, and planning and testing mitigating actions to reduce overall costs (Lyneis and Ford, 2007). In this case example, Fluor reports that their clients welcome their use of these project models, appreciating the foresight that aids the avoidance project cost surprises and also minimise capital expenditure. In fact an SD based model called 'change Impact Assessment' system to aid project management at Fluor Corporation has been used for over 100 Fluor projects with a resultant organisational wide better understanding of project-wide effects of changes, and cost savings for Fluor and its clients that is now estimated to be in excess of \$1.3 billion (Cooper and Lee, 2009).

SD project models have also been applied to investigate risk management as an aspect of project management. Case studies (Ford and Ceylan, 2002; Alessandri *et al.*, 2004; Johnson *et al.*, 2006) and comparisons with other approaches (Cao *et al.*, 2006) provide a basis for the feedback role in managerial real options. For example, Johnson *et al.* (2006) used SD to model and value flexibility in equipment delivery strategies in a large petrochemical project. And central to SD project models applied to project control is the rework circle as discussed earlier. The rework cycle is reportedly central to many adverse project dynamics to the extent that in order to control a project adequately, the rework cycle have to be recognised so that management actions can be taken to minimise its detrimental effects on project objectives.

To be succinct, SD project models as documented in Love *et al.* (2000; 2002; 2008), have been used to identify how managers can improve quality and reduce errors, recognise the existence of undiscovered rework and avoid its consequences, and also avoid the tendency to start downstream work too soon, which may increase the likelihood of unplanned concurrences (Lyneis and Ford, 2007). In addition, SD project models can help managers to significantly improve project performance through efforts directed towards easing performance targets by slipping milestone deadlines and greater efficiency in resource management. Sterman (2000) provide a comprehensive list of SD application areas in which project management related issues were addressed.

Therefore, measured both in terms of academic research and real world application, the use of SD to understand and improve project

management has been a great success (Lyneis and Ford, 2007). Though SD modelling is more strategic in nature than more traditional operational project management tools, its ability to complement other project management tools demonstrate its robustness. For instance, Park and Pena-Mora (2003; 2004) propose and apply an integrated dynamic schedule buffering using an SD model with critical path modelling. And more recently, SD was combined with DES to form a hybrid model developed to address non-value adding activities in construction by enhancing managerial decision-making abilities in the construction domain with the overall aim of improving performance in the strategic-operation phase of construction project management (Han, 2008; Pena-Mora *et al.*, 2008).

Most notably, all the aforementioned application domains demonstrate the ability of SD methodology to build theory and improve practice in the construction management domain. For instance issues relative to low productivity, error, and interruption that can potentially derail the execution of a construction project regardless of size and location can be modelled through SD. As indicated in Figure 2, Han *et al.* (2007) show that while traditional approaches lack the capability to deal with feedback mechanism related to errors and changes, an SD based simulation model was able to indicate that non-value adding activities in the construction process may become radically compounded by its interaction with errors and changes.

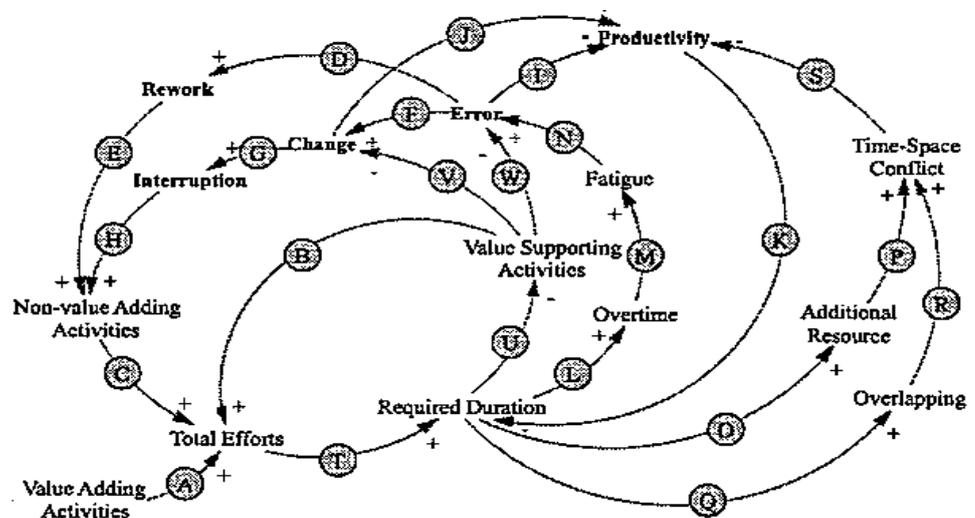


Figure 2 Feedback Mechanism Model (source: Han *et al.*, 2007: 2084)

Though the models described above differ in many ways, they nevertheless illustrate a number of principles for effective development and implementation of system dynamics models. These principles, include, *inter-alia* (Sterman, 2000):

- develop a model to solve a particular problem, not to model the system;
- modelling should be integrated into a project from the beginning;
- SD does not stand alone. Use other tools and methods as appropriate;
- focus on implementation from the start of the project;
- modelling works best as an iterative process of joint inquiry between client and consultant;
- validation is a continuous process of testing and building confidence in the model;
- a broad model boundary is more important than a great deal of detail, and
- implementation does not end with a single project.

4.0 CONCLUSIONS

Therefore, due the major advantage of SD in terms of its effectiveness in representing project environment, which include feedback and delay that explains chains of causality, SD is arguably very effective in incorporating management actions in the construction process to the extent that making its adoption at the strategic project management level, an wholesome decision that could set reliable strategic policy into motion in order to counteract the effects of difficult construction project management issues.

In addition, given the extent of its applications in the construction management domain especially with respect to contemporary issues such as project performance improvement, dispute resolution, human resource management, quality, H&S, and project delivery systems, its application in the South African context provides a platform for the construction management research to be truly linked with the expectations of the industry. For instance, despite numerous published research findings and Construction Industry Development Board (cidb) reports that addressed

perceived anomalies in the industry, and the attendant recommendations, anecdotal evidence suggest that the performance of the industry is not improving consummately.

A case in point is toning issues relative to quality of housing and contractor development. These two issues with the reported skills shortage in the industry may benefit from SD through the examination of policy resistant as existing findings and recommendations seem not to be changing the situations significantly. In brief, while acknowledging the existence of other modelling tools available to the construction management researcher, lessons from the applications of SD models to construction project management suggest that it is advisable to broaden modelling tools so that research outputs emanating from institutions especially at the doctoral level can be applied in the South African construction industry.

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Underlying Factors for Construction Research Collaboration in Ghana

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ABSTRACT

Purpose: This paper examines the underlying factors for construction research collaboration in the Ghanaian Construction Industry (GCI).

Design / methodology / approach: It determines the major factors that influence the decision to collaborate by construction researchers in the GCI by undertaking a survey of all 27 faculty members of the College of Architecture and Planning (CAP) in Kwame Nkrumah University of Science and Technology, Kumasi Ghana as at December, 2009.

Findings: The study identified quality outcomes, development of research skills, networking, sharing of responsibilities and complexity of research problem as the major determinants of construction research collaboration Ghana.

Originality / Value: Collaborative research in the construction industry is undoubtedly the basis for innovation and multiple-authored or co-authored publications have been frequently cited as the basic measure of research collaboration. A clear understanding of the underlying factors for construction research collaboration will help to properly streamline existing and future collaborations.

Key Words: Construction, Research, Collaboration, Ghana

1. INTRODUCTION

Collaborative research involves joint efforts by two or more entities in carrying out a research study. It can range from the interaction between a mentor and a student, to large consortiums of researchers / institutions spread across wide geographical regions (CDD-Ghana, 2005). It is the working together of researchers to achieve a common goal of producing new, significant knowledge, usually in the forms of journal and symposium article publications (Katz and Martin, 1997). Research collaboration is an excellent, sociable way to pool expertise, gain experience, and generate new knowledge in a timely manner.

Like many other developing countries, Ghana has increased demands on its built environment and thus requires continued and enhanced built environment research and development activities. Due to the fragmented nature of the construction industry and immense costs for developing innovative methods and products, using the capability of different partners within collaborative projects offers a cost-effective solution to this challenge (Sørensen and Maultzsch, 2004).

According to Katz and Martin (1997), there seems to be increasing interest among researchers and also within science policy circles on the issue of research collaboration over the past decades. Some of the reasons for the growing interest according to Smith and Katz (2000) include: the wide range of skills and expertise needed for successful research are rarely found in one researcher or institution; the need to break down institutional barriers among universities, industry, commerce, government and the public services; the complexity of some research problems and the need to ensure that research findings solve socio-economic and development problems.

The construction industry of Ghana is one sector which stands to benefit tremendously from collaborative research. It is for this research that this paper attempts to identify the common underlying factors that inform the decision to collaborate by Ghanaian construction researchers. The authors are of the view that clear understanding of the underlying factors for construction research collaboration will help to properly streamline such arrangements to take advantage of the many benefits it presents (Yeung and Chan, 2002; CDD-Ghana, 2005; Smith and Katz, 2000).

Research Collaboration

Smith and Katz (2000), identifies three major types of collaboration in research, namely corporate partnerships, team collaboration and inter-personal collaboration. CDD-Ghana (2005) while agreeing with Smith and Katz (2000) further stated that these are not stereotyped since variations can be observed in practice, while in some instances they may co-exist in various dimensions as part of a research strategy. Corporate partnerships are a kind of 'means to an end' collaboration. It is driven principally, but not exclusively by the desire to access external funding for a project. Key elements of this type of collaboration are; the partnership always has the intent of putting forward joint project funding proposals on behalf of all the institutions or individuals involved; the partnership offers a formalized network for discussing, developing, implementing, coordinating and delivering the partnership's strategic goals; and the partnership's strategic

goals have direct relevance to all the partners, though all partners may have different motivations for desiring to meet these goals.

Team Collaboration on the other hand is semi-formalized although not defined as formal partnerships. The motivating factor for this type of collaboration is the need for multi-disciplinary skills and experience. Some of the main features are; it is research-focused and task-based; researchers may come from different backgrounds and institutions such as universities, industry, public and non-public institutions and other professional fields; the continuous existence of the collaboration is largely determined by the availability of funds, which is both a stimulant and problem for longer-term stability.

Inter-personal collaboration is mostly driven by the desire for interdisciplinary research. It is essentially dependent on personal relationships among institutions and / or individuals. Key elements of the inter-personal model are; it is people driven; it is founded on trust and ability to work together; it is organic in nature because partners join and / or leave as and when necessary; and it is characterized by regular face-to-face contact.

Collaborative Research Benefits

The benefits of membership can be many and include but not limited to the following: industry driven collaborative research; access to innovative practices; tool and guidance documentation to improve efficiency; being placed to reap the rewards from increased productivity and profitability; networking with all disciplines within the industry; being part of a forum that sets standards across the industry; and increased profile, marketability, peer and media interest (Yeung and Chan, 2002).

CDD–Ghana (2005) grouped collaborative research benefits in terms of the three models for collaboration they identified, namely corporate partnerships, team collaborations, and personal collaborations. Benefits of corporate partnerships include: helps in identifying institutional complementarities and allows for pooling of resources; helps in building the capacity of less established research institution; leads to improved access to external resources, previously unavailable; leads to building institutional capacities to work strategically and impacts on key areas of joint interest; and significantly helps in forming critical research mass at both national and sub-regional level. Benefits of team collaborations include: supports the development of appropriate multi skills / expertise; and boosts and advances the knowledge / understanding of research agenda. For personal collaborations, the benefits are likely to include: helps in the intellectual and disciplinary development of partners; provides the necessary vibrancy for growth of sustainable research networks; and highly beneficial for teaching / training in research.

According to CDD–Ghana (2005), apart from the three models of benefits mentioned above other benefits such as credibility of research findings, yields quality research work as a result of the varied expertise

involved, and protects partner institutions / researchers from the explosive political dimensions of the research findings when disseminated and cited.

A Good collaborative working environment based on collaborative systems including both general collaborative infrastructures and specific applications for supporting human-centric collaboration will offer seamlessly integrated context-aware flexible support for distributed collaboration among individuals and organizations (Mehandjiev and Stokic, 2006). Collaborative infrastructures provide pro-active support for pervasive human collaboration within their own organisations, with other organisations and with virtual communities of experts and of practice. These provide system components that allows for effective use of distributed knowledge and competences. Collaborative working environments offer benefits at all levels. At organisation level, it allows for a faster time to market, increase business model innovation, better consistency of cross domain processes, and improve flexibility and lead time in global product development. At team level, it helps lessen misunderstandings, increase re-use of shared information and knowledge, and make more efficient task management and allocation through competence networks. At individual level, it can help boost creativity by reducing routine work, improve use of idle time through pervasive collaboration services and allow natural human interactions within a group.

Collaborative Research Challenges

Due to the complexities of collaboration, collaborative research poses significant administrative, professional and ethical challenges to individuals / institutions involved in such partnership (CDD-Ghana, 2005). CDD-Ghana (2005) explained some of the professional challenges facing most research collaborations such as; what memorandum of understanding should be reached among partners to prevent them from disseminating findings of collaborative research individually; how to resolve problems associated with the review of inter-disciplinary proposals funded by different donor agencies / organizations with varied conditions / criteria; and how to resolve conflict arising from the different missions of collaborating individuals / institutions e.g. educational institution–industry collaboration where the former mission emphasizes full disclosure and publication of research findings to aid academic training while the latter, due to its profit oriented motive cherishes limited disclosure, proprietary restrictions because such findings are perceived as marketable product. They further explained some of the administrative challenges such as how to; minimize competition between institution-specific research and collaborative research for limited resources of the institution; share control over the research process i.e. from conceptualization through implementation to dissemination of results equally among collaborating partners; ensure that partners in collaboration have equal voice in decision-making; and ensure that partners comply with material transfer agreements.

Fundamental to all collaborative research challenges is trust. Trust is mutually reinforcing. From a certain level in a professional career, reputation or intermediated trust will lay the foundations for further opportunities to build process-based trust in select research circles and networks. Trust in professional competence and in the personal integrity and credibility of a researcher is very closely interwoven. Because character assessment and the professional standing are closely interwoven and scientists have to rely on each other for their research, appropriate social and professional behaviour are part of the 'scientific socialisation process' and will become part of 'impression management' of the individual members of the research community. Professionalism has traditionally been linked to trustworthiness in that the commitment of managers and professionals to do a 'professional job' was seen as the basis for bestowing trust onto them and their work (Kimball, 1992).

In finding a way round the problem of trust, Zucker *et al.* (1996) determined that by keeping sensitive information within organisational boundaries, the risk of accidental disclosure of this information to outsiders is greatly reduced and employee contracts in general and secrecy clauses in particular can be used to deter employees from purposeful betrayal of their employer's trust. The purest form of such internalised control is the ideal type of bureaucratic control, where tasks and responsibilities and hence access to information are divided, narrowly defined and regulated and detailed rules and procedures allow for a close monitoring of staff performance and behaviour (Hoecht and Trott, 1999). Garsten and Grey (1998) observed that the problem of trust in individuals in such bureaucratic organisations is theoretically solved. In research-led organisations, however, bureaucratic control systems are unlikely to work well because the scope of projects cannot be clearly defined in advance, the tasks are frequently non-routine in nature and the success of the projects depends heavily on the individual professional expertise and commitment of the scientists involved (Perrow, 1970).

Merton (1973) determined that academic credibility relies on openness and publication of research findings as only published findings can be scrutinised, peer-reviewed and credited to the research team that made the discovery. Hoecht (2004) observed that research networks illustrate particularly well the relationship between academic credibility, reputation and trust. The credibility of researchers, the scientific community's trust in the validity of their research and, closely linked, their personal integrity or trustworthiness, tend to be directly related to their accumulated social capital in the research community: accumulated direct interpersonal experiences with other researchers (process-based trust), reputation (intermediated trust), academic peer-review and recognition by research organisations (institutional trust) all contribute to the professional standing of established researchers (Hoecht, 2004).

Method

A questionnaire survey approach was adopted for this study. The questionnaire was designed to have respondents rate sixteen (16) variables identified from literature as determinants of research collaboration (CDD-Ghana, 2005; Katz and Martin, 1997; Sørensen and Maultzsch,

2004; Yeung and Chan, 2002; Hoecht, 2004). The rating involved the respondents deciding whether the given variable is 'Not important', 'Less important', 'Quite important', 'Important' or 'Very important' on a scale of 1 to 5, with 1 for 'Not important' and 5 for 'Very important'.

All members of faculty in the College of Architecture and Planning of KNUST as at December, 2009 were involved in the study. This census sampling technique which allows for data to be collected from the entire population was adopted to help eliminate sampling errors and provide data on the entire population which was rather small. Data was thus collected from all fifty-five (55) members of faculty in the college with twelve (12) of them coming from the Department of Architecture, eighteen (18) from the Department of Building Technology, sixteen (16) from the Department of Planning and nine (9) from the Department of Land Economy. A total of twenty-seven (27) questionnaires were retrieved answered by respondents out of the fifty-five (55) questionnaires distributed giving a response rate of 49%.

Data gathered from the respondents was subjected to factor analysis using the SPSS. Factor analysis is a statistical technique used to identify a relatively small number of factors that explain observed correlations among variables (Marija, 2003). It is primarily used for data reduction or structure detection with the assumptions that the variables are continuous, normally distributed, have a good linear relation between them and have underlying factors responsible for the observed correlation. Factor analysis is used when people have been measured on several continuous variables and it is wished to see whether these variables can be reduced to a smaller set of variables (Chris, 2004; Marija, 2003).

Results

Even though the sample size used for the study was smaller than that recommended for factor analysis, and given that the results of the Bartlett's test of sphericity and Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy for the data as indicated under Table 1, were not appropriate for factor analysis (Coakes and Steed, 2001), the authors went ahead to use factor analysis as this work is only meant to test the methodology for a much more extensive research which is currently on-going. The method used for extracting the factors is the principal component analysis where linear combinations of observed variables are formed. The first principal component (factor) is the combination that accounts for the largest amount of variance and the second principal component (factor) that accounts for the next largest amount of variance and is uncorrelated with the first.

Table 1: Results from Factor Analysis

Item	Mean	Std. Deviation	Component matrix					Rotated Component matrix				
			1	2	3	4	5	1	2	3	4	5
Enhance understanding of research agenda	4.26	0.915		.709				.798				
Enhance research expertise	4.13	0.815	.877									
Breakdown of institutional barriers	3.35	1.265										
Complexity of research problem	3.57	1.161		.531		.517	-.504					.852
Protection from explosive political dimensions of findings	3.30	1.579										
High quality research	4.26	0.810	.830					.765				
High credibility of findings	4.26	1.096	.851					.775				
Sustainable research network	4.04	0.878		.728						.809		
Enhance appropriate multi skills	4.48	0.730		.654					.835			
Formation of critical research mass	3.61	1.033	.530									.671
Access to external resources	3.96	1.065		.723					.618			
Complementarities and pooling of resource	4.22	1.126	.809					.885				
Generation of new set of knowledge	4.22	0.795	.691					.636				
Shared control over research process	3.30	1.146		.543		-.531						.944
Minimize competition	3.22	1.313		.746					.741			
Applied and cross-disciplinary findings	4.17	0.984			-.586					.827		

Note:

Extraction method: Principal Component Analysis

Rotation method: Varimax with Kaiser Normalisation.
 KMO value = 0.429
 Bartlett's Test of Sphericity Significance level = 0.000
 Insignificant factor loadings (i.e. < .50) are blanked.

Table 1 presents the results of the factor analysis carried out on the data collected. Since a 5 point Likert scale i.e. 1 to 5, with 1 for 'Not important' and 5 for 'Very important' was employed, a mean of 2.50 was taken as the cut off point. Thus a factor is deemed to be significant to the study if it has a mean value of 2.50 or more. As observed from Tables 1, all 16 factors had means greater than 2.50 hence were included in the factors analysis. In order to empirically explain the major determinants of collaboration in construction research, the 16 factors deemed significant to the study were further reduced to common factor patterns. In doing this, principal component analysis using Varimax rotation with Kaiser Normalisation was employed to determine which factors have empirical significance. Factor retention was by the eigenvalue ≥ 1.0 criterion and that only factor loading of 0.50 or higher was considered significant. Also factors with significant cross-loading i.e. factors with factor loadings ≥ 0.50 on more than one factor component were deleted and the factor analysis repeated. Each factor thus had large loadings in absolute value for only one factor component. The deleted factors included 'breakdown of institutional barriers' and 'protection from explosive political dimensions of findings'.

The 16 factors identified as significant determinants of construction research collaboration in Ghana were thus reduced to the following 5 components employing factor analysis:

- Component 1: High quality research, high credibility of findings, complementarities and pooling of resource, and generation of new set of knowledge.
- Component 2: Enhance understanding of research agenda, enhance appropriate multi skills, access to external resources, and minimize competition.
- Component 3: Sustainable research network, and applied and cross disciplinary findings.
- Component 4: Formation of critical research mass and shared control over research process.
- Component 5: Complexity of research problem.

Investigating the underlying factors making up each component, it can be concluded that: Quality outcomes (Component 1); Development of Research Skills (Component 2); Networking (Component 3); Sharing of Responsibility (Component 4); and Complexity of Research Problem (Component 5) are the major determinants of construction research collaboration Ghana.

Table 2: Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.886	27.754	27.754	3.886	27.754	27.754	3.525	25.181	25.181
2	3.707	26.478	54.232	3.707	26.478	54.232	2.777	19.834	45.015
3	1.566	11.186	65.418	1.566	11.186	65.418	1.993	14.234	59.249
4	1.193	8.519	73.937	1.193	8.519	73.937	1.889	13.493	72.743
5	1.020	7.284	81.221	1.020	7.284	81.221	1.187	8.479	81.221
6	.801	5.722	86.943						
7	.516	3.685	90.629						
8	.398	2.842	93.471						
9	.294	2.102	95.572						
10	.229	1.634	97.206						
11	.196	1.399	98.605						
12	.092	.654	99.259						
13	.065	.464	99.723						
14	.039	.277	100.000						

Extraction Method: Principal Component Analysis.

As seen from Table 2, component 1 has total variance of 3.886, which is 27.75% of the total variance of the 14 factors; component 2 has total

variance of 3.707, which is 26.48% of the total variance of the 14 factors; component 3 has a total variance of 1.566, which is 11.19% of the total factors; component 4 has a total variance of 1.193, which represent 8.52% of the total factors; and component 5 has a total variance of 1.020, representing 7.28% of the 14 factors. In all 81.22% of the total variance is explained by the 5 components resulting from the above analysis.

Discussion

Based on the examination of inherent relationships among the factors identified under each component, the following interpretations were made to explain the underlining issue linking the factors.

Components 1: Quality Outcomes

Component one comprised four factors namely; high quality research, high credibility of findings, complementarities and pooling of resource, and generation of new set of knowledge with factor loadings of 0.765, 0.775, 0.885 and 0.636 respectively. A close examination of these factors points one to the common underlying issue of the outcome of the research. Potential construction research collaborators just as most researchers are keen in producing the best out of their research. This most often is achievable when researchers pool their expertise together. Collaboration may also bring about a clash of views, a cross-fertilisation of ideas which may in turn generate new insights or perspectives that individuals, working on their own, would not have grasped or grasped as quickly (Katz and Martin, 1997). The act of collaborating may thus be a source of stimulation and creativity (Katz and Martin, 1997). Innovation in buildings, housing and construction technology demands a capability in research and technical development which is able to solve complex and multidisciplinary problems. It was observed by Sørensen and Maultzsch (2004) that the principal building research institutes in Europe, represented by the institutional network ENBRI, offer comprehensive experience in a wide range of disciplines, with in-depth knowledge in specialist fields at different locations, which can be combined for solving particular problems with high scientific input and the use of often unique test facilities. The use of this huge potential by the construction industry and policy bodies to create construction innovation can be seen as one of the issues underlying research collaboration. One of the main drivers of research collaboration is the quality of the research produced in the end; researchers interested in producing high quality research and credible findings will pool their resources together to enable them generate new set of ideas and knowledge for the betterment of the scientific community. Collaboration thus ensures a more effective use of talents and leads to higher output.

Component 2: Development of Research Skills

Component two comprised of four factors namely; enhance understanding of research agenda, enhance appropriate multi skills, access to external resources, and minimize competition with factor loadings of 0.798, 0.835, 0.618 and 0.741 respectively. These factors centre on development of research skills of potential collaborators. Smith and Katz (2000) opine this in their research that one of the benefits from collaboration is the sharing of knowledge, skills and techniques. They state that in collaborations, there may be a fairly formal division of labour, for example, one person may be good at constructing, operating and maintaining scientific instrumentation and another at analysing the data produced. CDD-Ghana (2005) was also of the same view that research collaboration supports the development of appropriate multi skills and advances the knowledge/understanding of research agenda. Most researchers will thus collaborate to enhance their skills and increase their depth of comprehending the research agenda. Due to the fragmented nature of the construction industry and immense costs for developing innovative methods and products, using the capability of different partners within collaborative projects offers a cost-effective solution to this challenge (Sørensen and Maultzsch, 2004). CDD-Ghana (2005) also noted that collaboration leads to improved access to external resources, previously unavailable. Potential researchers will like to collaborate to increase their accessibility to resources that previously were not available to them. Collaboration between different researchers offers excellent knowledge and experience. The special experience and competence of individual researchers are combined in research collaboration to create multidisciplinary and user oriented research and innovation.

Component 3: Networking

Component three comprised two factors namely; sustainable research network, and applied and cross-disciplinary findings with high factor loading of 0.809 and 0.827 respectively. The environment created by potential collaborators creates a social network by which they can interact with members of this network. Katz and Martin (1997) noted that, the benefits of working with others are not confined to the links with one's immediate collaborators. Collaboration also has the effect of 'plugging' the researcher into a wider network of contacts in the scientific community (Katz and Martin, 1997). An individual may have good contacts with 50 or 100 other researchers in his or her field around the world whom he or she can contact for information or advice. They opine that by collaborating with others in another institution or country, the individual can greatly extend that network.

Collaboration also provides intellectual companionship. Research can be a lonely occupation, probing the frontiers of knowledge where few, if any, investigators have been before (CDD-Ghana, 2005). An individual can partly overcome that intellectual isolation through collaborating with others, forming working and perhaps also personal relationships with them. Researchers stand to gain from each other as they increase their social network and are able to further gain more from individuals they find within their new extended research network. In addition to this, collaboration can enhance the potential visibility of the work. Using their network of contacts, one's collaborators can diffuse the findings, either formally (e.g. through pre-prints, seminars or conference presentations) or through informal discussions. Once published, the paper may be picked up in library searches by scanning for work produced by any of the collaborating authors, multiplying the chance that it will be located and used by others. Developing a sustainable research network has always been one of the underlying factors for research collaboration. Social capital has an important part to play in the establishment and maintenance of any collaboration and consequently can be viewed as an ingredient that binds the whole collaboration process together (Philbin, 2008).

Component 4: Sharing of Responsibility

The factors in component four comprised of; formation of critical research mass and shared control over research process each of these with factor loading of 0.671 and 0.944 respectively. Most research collaborators will come together to help reduce the workload that one individual will have to face alone. Potential collaborators will like to have control over the research process in so doing they will designate certain aspects of the research process to each other. CDD-Ghana (2005) observed that research collaboration significantly helps in forming critical research mass at both national and sub-regional level. As put forward by Katz and Martin (1997) one of the benefits of collaboration is the transfer of knowledge or skills. As noted earlier, it can be time-consuming for an individual to update his/her knowledge or to retrain (Katz and Martin, 1997). Modern research is increasingly complex and demands an ever widening range of skills. Often a single individual will take a lot of time to develop the needed research material. If two or more researchers collaborate there is a greater probability that between them they will possess the necessary skills and will have the benefit of sharing the responsibility of conducting the research. Research Collaborators will complement each other in the research process. It is thus observed that the sharing of responsibility is one of the key determinants of collaborating in a research process.

Component 5: Complexity of Research Problem

Component five comprised only of complexity of research problem with a high factor loading of 0.852. Due to the nature of the construction industry and its attendant problems, researchers must have a capability in research and technical development which is able to solve complex and multidisciplinary problems. Most potential collaborators will thus come together as a result of how complex the research problem is. Construction is a very competitive and risky business. Its competitive nature, coupled with the conflicting objectives of participants in construction processes have posed a number of shortcomings to the industry and makes conducting research very complex. A research by Yeung and Chan (2002) showed research is a key driver to steadily improving the overall performance of the construction industry through technology upgrading. They however stated that due to the complexities in the built environment, the industry and the local research community should work in collaboration to set clear objectives, directions and priorities for local construction research, to raise awareness of research results and to facilitate their practical application (CIRC, 2001). A key factor underlying research collaboration in the construction industry is thus the complexities and difficulties of the problems in the industry.

Conclusion

Collaborative research in the construction industry is undoubtedly the basis for innovation and provides opportunities for the generation of new sets of knowledge. It has to do with synergy and is one of the driving factors behind the development of most construction industries the world over. This paper examined the common underlying factors that inform the decision to collaborate by Ghanaian construction researchers. Sixteen (16) factors identified as significant determinants of construction research collaboration in Ghana were reduced to 5 components employing factor analysis. The first component consisted of high quality research, high credibility of findings, complementarities and pooling of resource, and generation of new set of knowledge. The second component comprised of enhance understanding of research agenda, enhance appropriate multi skills, access to external resources, and minimize competition whiles the third component consisted of sustainable research network, and applied and cross-disciplinary findings. Component four consisted of formation of critical research mass and shared control over research process and component five consisted solely of complexity of research problem. Investigating the underlying factors making up each component, it was concluded that: quality outcomes (Component 1); development of research skills (Component 2); networking (Component 3); sharing of responsibility (Component 4); and complexity of research problem (Component 5) are the

major determinants of construction research collaboration Ghana. The authors are of the view that, a clear understanding of the above five components as the underlying factors for construction research collaboration in Ghana will help to properly streamline such arrangements and in so doing, take full advantage of the many benefits collaborative research.

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Housing construction in the built environment: The case of urban growth in metropolitan Lagos

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ABSTRACT**Purpose:**

This research focuses on the spatial growth and the rapid rate of development in Metropolitan Lagos in order to show the significance and the role of housing in the study area. Lagos remains the most populous and unequalled state in Nigeria with most of its population concentrated in the Metropolitan area. It follows that housing for the people should be adequately researched as shelter is one of the foremost priorities of life that contributes to development. The problem of study is the examining of the continuous expansion of the metropolitan vis a vis housing construction. That is, has the continuous expansion of the mega city be able to cope with the housing need and construction?

Methodology:

The study is based on data collected from seventeen Local Government Areas consisting of 53 residential zones in metropolitan Lagos. Out of the total number of 135,850 properties, a size of about 1% (1,410) was randomly selected. The valuation of properties in all the local governments contains data and information on the number of houses, the valuation area, owner, area of land, address of property, type of occupier, rental information, type of accommodation, gross value, rateable value, etc. The multiple regression analyses were used to explain the relationship between the housing variables while maps were used to explain the spatial growth and the rapid rate of development.

Findings:

The findings show the alarming expansion process of the mega city which has not been able to cope with the housing need. The growth of housing in Lagos is both phenomenal and unprecedented in the annals of development. Lagos epitomises the phenomenal growth in urban population that is almost typical of most African cities. The result shows the unequal housing and the spatial structure of metropolitan Lagos. The mean values are high because of the rapid expansion and conglomeration of the city. The analysis explained the different phases of the city growth.

Value of the paper:

When we compare the official documents processed for building construction and the city growth, they are not at par. The figures are to show the number of building constructions and the urban growth of the city. The figures are low compared to thousands of unregistered buildings that have been built which should be a major concern to development control, city managers, government policy makers and other allied professionals in housing to make valuable and quality decisions.

Key words: Built environment, building construction, city growth and housing market.

1. INTRODUCTION

Different models of built environment and residential location explain the spatial pattern of residents according to the housing market structure in metropolitan Lagos (Aluko, 2008). While no one showed any discernible spatial variation, they undoubtedly provide explanations based on the historic development of the city (Mabogunje, 2007, Aluko, 2008). Although, the macro-economic theories which involve the urban spatial structure and the ecological approach to urban land values provided a number of elements explaining the location behaviour of households and groups (Aluko, 2004, 2008), this study applied the models to housing to explain urban growth according to the choice of residential locations. The paper highlighted the significance and the role of housing in Metropolitan Lagos. It examined the spatial growth and the rapid development of housing in view of the economic and human ecological analyses of urban structures. The study is based on data collected from 17 local government areas consisting of 53 residential zones in metropolitan Lagos. Also, the research focuses on building construction and the rapid rate of development in metropolitan Lagos and how it affects the built environment and the mega city.

That is, this paper focuses on the spatial growth and the rapid rate of development in Metropolitan Lagos in order to show the significance and the role of housing in the study area. Since Lagos remains the most populous and unequalled state in Nigeria with most of its population concentrated in the Metropolitan area (Mabogunje, 2007), it follows that housing for the people should be adequately researched as shelter is one of the foremost priorities of life. The problem of study is the examining of the continuous expansion of the metropolitan vis a vis housing construction. That is, has the continuous expansion of the mega city be able to cope with the housing need and construction. Also, obtaining reliable and accurate information on housing units as in the case of Metropolitan Lagos constitutes a crucial step towards a better understanding of the structures of the housing market in Lagos. The comprehensive survey of all the buildings in 2007 which is being periodically reviewed provides easy access to data and qualitative explanation of the spatial variations of the housing attributes.

2. LITERATURE AND CONCEPTS OF URBAN POPULATION GROWTH

Jones (1966) in his 'Human Geography and Settlement' refers to West African towns as urban villages, remarking that their only qualification for the urban status is their size. This has always been the attitude of many foreign writers in defining an urban settlement in this part of the world. In fact, the term "Urbanization" is a rather subjective concept which has been given different interpretations in many books depending on the purpose and criteria used. In Europe, size alone does not qualify a settlement to be designated as an urban settlement, it must satisfy other conditions, namely that it is usually an administrative, educational, service, commercial and in some cases, an industrial centre. In this case, most of the inhabitants are not in any way connected with the land. This is not the situation here, and it is this that has led foreign writers to refer to our urban settlements as out-sized villages.

Dickinson (1965) also wrote that "a town is a compact settlement engaged in non-agricultural occupations". It is difficult to see how this applies to Nigerian towns where the majority of urban dwellers also engage in farming. According to Mabogunje (1968), he said what is missing in that definition is the time perspective.

In as much as it is not easy to define the concept 'housing'; the word 'urban' is a bit more difficult. Like its rural concept, there have been problems of urban definition where no single criterion could be used since some countries have low figures while others have high figures. There is a demographic definition of using minimum population thresholds. One common indicator of urbanity that has been used in different parts of the world is population size. Often the minimum population figures that a place must have to qualify as an urban area is specified. This minimum population size varies from one place to the other depending on the situation of the country concerned. It has been noted that a population of 2,500 and above is the distinction on which urban places are recognized in the United States (Onibokun, 1990). However the figures used in other countries vary remarkably from that of United States. In Denmark, an urban place is an agglomeration of 250 or more people. In Greece, urban places include agglomerations of 10,000 or more, whereas Guatemala has considered places as urban if they have 2,000 or more inhabitants, plus places with 1,500 or more inhabitants of running water service is provided in the houses. These are examples of the variety of ways in which urban areas are defined in different countries on the basis of the threshold population. According to the Nigerian (1952) census, an urban place is an area having a population of more than 5,000. By contrast, the 1963 census fixed 20,000 and above people. Compare these figures with those of France (2,000 and above), Canada (above 1,000) and Japan (above 30,000).

The term 'urban' has therefore generated more controversy in the literature and involves economic, sociological, psychological, ethnic, racial, and numerical dimensions. To date, very little urban economic-geographic analysis of housing markets and construction in developing countries has been undertaken (Aluko, 2008). While Megbolugbe's (1983) study of Jos stands out as the pioneering attempt at analyzing the consumption relationships of housing in a private owned housing market in Nigeria, Arimah's (1990) study of Ibadan identified some of the significant aspects neglected in his study of housing and city growth in the literature. While

explanations were sought to resolve some of the identified gaps, issues of spatial scale for delineation of submarkets and for consideration of neighbourhood variables were not adequately treated in both studies. Aluko (2004) studied housing attributes and their effects on Lagos urban prices, while a further expansion of the research work in 2008 examined the urban growth and housing construction. Other related studies include Mabogunje (2007) and Ayeni (2007). Although, the macro-economic theories which involve the urban spatial structure and the ecological approach to urban land values provided a number of elements explaining the location behaviour of households and groups, the study applied the models to housing to explain urban growth according to the choice of residential locations.

3. STUDY AREA AND METHODOLOGY

The study area, Metropolitan Lagos developed from a narrow low-lying island situated on latitude 6°27' North and longitude 3°28' East along the West African coast. Lagos comprises the former 70 square kilometres of the Federal Territory of Lagos which was composed of the geographically formed islands of Eko (Lagos Island), Ikoyi, Victoria Island, Iddo-Otto, Ijora and Apapa. The central and most developed of this island chain is Lagos Island. It also incorporates the municipal settlements of Ebute-Metta, Yaba, Surulere, Tin-Can Island (Mekuwun) and the Eti-Osa areas all of which cover 85.53 square kilometres. From this initial settlements, development has proceeded northward to the mainland up to about latitude 6° 40' North. The Lagos Metropolitan Area located within Lagos State in the south western part of Nigeria serves the dual purpose of being a state and former national capital. It still serves as the country's commercial centre. With an annual population growth rate of about 13.6 per cent (about 5 times as fast as the national growth rate of 2.8 per cent). Lagos is Africa's second fastest growing urban centre after Cairo, being a focal point for regional, national and international trade and served by significant, and often overloaded, rail, ocean and air transport facilities.

The study is based on data collected from seventeen Local Government Areas consisting of 53 residential zones in metropolitan Lagos. Out of the total number of 135,850 properties, a size of about 1% (1,410) was randomly selected. The valuation of properties in all the local governments contains data and information on the number of houses, the valuation area, owner, area of land, address of property, type of occupier, rental information, type of accommodation, gross value, rateable value, etc. Other secondary data consist of relevant information from journals, articles, research reports from government agencies and parastatals. Primary information was collected from both direct interviews and personal observations. The main primary information was obtained from responses to questionnaires administered by the author and trained assistants. This is essentially to complement the already available secondary data and other unavailable necessary information. The selection of the houses covered by the questionnaire was done by both the random and systematic sampling methods in the Metropolitan areas. The multiple regression analyses were used to explain the relationship between the housing variables while maps were used to explain the spatial growth and the rapid rate of development.

4. RESULTS AND DISCUSSION: SPATIAL EXPANSION

Lagos epitomises the phenomenal growth in urban population that is almost typical of most African cities. Table 5.1 shows housing and the spatial structure of metropolitan Lagos. That is, the number of buildings in different neighbourhoods, the house values, number of persons per room and the density. These mean values are high because of the rapid expansion and conglomeration of the city. Figures 5.1 and 5.2 also show the built up areas in 1964 and 2008. Table 5.2 gives the number of buildings applied for and the number approved between 2000 and 2006. The figures are to show the number of building constructions and the urban growth of the city. Even though the figures are low compared to thousands of unregistered buildings that have been built but we still have the official figures to show the nature of the city growth. The analysis that follows tries to explain the different phases of the city growth.

Estimates made in the latter part of the 18th and the early part of the 19th centuries gave the population as 3,000 in 1800 (Adams, 1900), 20,000 in 1863 and 40,000 in 1864 (Colonial Possessions, 1863 and 1864). Within the first five years after 1966 (see Table 5.3), the population increased by about 14 per cent. The population growth rate for the city took a sharp turn in the 20th century. Between 1901 and 1911, the intercensal increase rose from 28.7 to 76.3 per cent. The trend in growth in the latter part of the century has been more dramatic (see Figure 5.1). In the first 13 years, that is 1950 to 1963, the population of the municipality increased threefold from 230,256. In 1973, the intercensal percentage decreased from 188.9 per cent to 117 per cent and by 1988, it decreased further to 50.2 per cent. The 1991 census gave a ridiculous low figure of Lagos Island as 335,300 (Lagos Island and Eti-Osa) and 4,248,963 when the Lagos Mainland figure is added to it. By 2006, the Nigerian Population Commission put the population of Metropolitan Lagos at 8,166,217 (see Table 5.4).

The areal distribution of population in Lagos, 1991-1991 shows that in 1991 Lagos Island constituted 76.8 per cent of the population while Mainland District contributed the remaining 23.2 per cent unit. In 1952, the population reduced to 49.3 per cent in the Island. While the Mainland population increased to 28.5 per cent. The city outskirts of suburbs which incorporate the new metropolitan settlements constituted the remaining 22.2 per cent. The 1963 census gave the areal population distribution as 26.9 per cent for Island. 31.9 per cent for Mainland District and 41.2 per cent for the new settlements. The distribution shows a continuous decrease in population in Lagos city and increase in population towards the hinterlands. This trend is further confirmed by the 1991 census which shows that Lagos Island has 335,300 population (7.9 per cent), Lagos Mainland 869,601 (20.5 per cent) and the other Metropolitan settlements 3,044,062 (71.6 per cent). The 2006 census gave Lagos Island population only at 209,437. Generally, the Lagos Metropolitan population has been on the increase since 1911-2006.

Also, the spatial variation of housing values in metropolitan Lagos involves the groups of variables of the attribute matrix (35 in all) described in table 5.5 were subjected to a factor analysis from which emerged three dimensions. The three dimensions explained a total of 62.4 percent of the variance contained in the original variables. The first dimension, which

dominates the housing values of metropolitan Lagos accounts for 46 percent of this explained variance while the other two components explain 16.6 and 16.4 percent's respectively (see Table 5.6). The factor loadings show the extent, to which each variable belongs to or is mostly associated with the factor, while the factor scores show the performances of the cases on the factors.

Two main factors account for the rapid growth of Lagos Metropolitan population – net migration and natural increase. Immigration has been a much more potent factor accounting for the rapid population growth in Lagos. By 1944 the whole of Lagos Island has been built up. The built up areas on the Mainland extends from the south-eastern portion of Ebute-Metta to Yaba and to some portions of the south-western part of Apapa. Many villages dot the landscape in areas north and west of the Mainland. Within another decade, new areas were being opened up for development. There has been much changes brought about in the residential extent by 1964. This expansion process is on the increase. The whole built up area from Ikoyi Island in the South-eastern part of Lagos Island to Agege in the extreme north forms the Metropolitan Lagos on an area of about 181 square kilometres. In 1993, the areal extent of the built up areas of Metropolitan Lagos is about 405.53 square kilometer while in 2008 the areal extent is 999.60 square kilometre. Not only has the rapid rate of the population growth contributed to the areal expansion of the Metropolis, it has also affected the distributional pattern of the people.

5. APPLICABILITY OF URBAN SPATIAL STRUCTURE THEORIES

The growth of housing in Lagos is both phenomenal and unprecedented in the annals of development. The earliest occupied area of the metropolis is the Lagos Island which started developing with the arrival of different groups of migrants. This Central Business District (CBD) is the point of maximum accessibility where majority of the economic activities are located. Major commercial concerns were established on the Island over the years, further concentration of economic activities resulted in its overwhelming importance as the Central Business District. To the north of the CBD is what would represent the second concentric zone. The zone is characterized by high population density, high occupancy ratio and high housing density. Many of the indigenes tend to stay put in their traditional houses or area, thus aggravating the slum problem.

This zone is followed by the working men's zone, a zone occupied mainly by industrial workers who have escaped from the second zone as their income increased. However, since this group of people still desire living close to their working place, they choose this adjacent zone which is a zone of second

under this zone by sea inlets. However, some of the housing characteristics postulated or the working men's zone in the concentric zonal model is evident in this area. The zone is an area of high occupancy ratio and high housing density but the living conditions are much better compared with those on the Island. The houses are of medium grade, multi-family tenements. On the contrary, exceptionally low housing density areas and relatively high income residential portions with relatively good supply of social amenities are found in certain places such as the Railway Quarters in Ebute-Metta and north eastern part of Yaba. The initial clustering of people in these localities illustrates the settlement pattern postulated by the sector model.

Table 5.2 Yearly Analysis of Building Applications Received, Approved and Collected 2000-1006

Year	Received	Approved	Collected
2000	6035	5872	383
2001	686	347	304
2002	699	421	389
2003	611	479	403
2004	604	544	241
2005	424	351	295
2006	2777	1931	1693

Source: Land Use and Allocation directorate, Lands Bureau, 2008

Table 5.3: Lagos City Population Growth Rate 1886 – 2006

Year	Area Covered in km ²	Total Population	Inter-Censal Percentage Increase or Decrease	Rate of Change Per Annum For 1000 People	Average Inter-censal Growth Rate Per Annum	Annual rate of Increase
1866	3.97	25,083	-	-	-	-
1871	4.01	28,518	13.7	-	-	-
1881	4.01	37,452	31.3	13	-	-
1891	4.01	32,508	13.2	-	-	-
1901	-	41,847	28.7	-	-	2.5
1911	46.62	73,766	76.3	58	-	5.7
1921	52.24	99,690	35.1	31	-	3.1
1931	66.28	126,108	26.5	24	2.3	2.3

1950	70.50	230,256	82.6	32	1.2	3.3
1963	70.50	665,246	188.9	86	8.5	8.0
1988*	405.53	2,168,163	50.2	-	-	-
1991	405.53	4,248,963	96.0	-	-	-
2006	999.60	7,937,932	86.82	-	-	3.2

Source: Population Census of Nigeria 1931, 1950, 1963, 1991 and 2006.
Note - Not available *Projection

Table 5.4: Population of Lagos 1970-2006

Year	Metropolitan '000	Rate of Growth	Non- Metropolitan '000	Total '000	% Metro
1978	3,779	9.3	521	4,300	87.88
1979	4,133		517	4,680	88.31
1980	4,518	7.27	574	5,092	88.72
1981	4,923		601	5,524	89.12
1982	5,302		629	5,931	89.40
1983	5,677		657	6,931	89.62
1984	6,048		688	6,734	89.81
1985	6,614	5.56	716	7,132	89.96
1986	6,791		717	7,538	90.09
1987	7,178		779	10,125	90.21
1988	7,580		812	10,125	90.32
1989	7,989		817	11,001	90.41
1990	8,406	4.37	881	9,290	90.49
1991	8,787		917	9,710	90.55
1992	9,173		952	10,125	90.60
1993	9,565		988	10,125	90.63
1994	9,975		1,026	11,001	90.67
1995	10,408	4.48	1,063	11,471	90.72
1996	10,861		1,105	11,966	90.76
1997	11,342		1,147	12,489	90.81
1998	11,842		1,191	13,039	90.87
1999	12,384		1,296	14,620	90.92
2000	12,949		1,283	11,232	90.96
2006	15,639	3.2	2,175	17,166	91.10

Source: Master Plan Project, Lagos State Ministry of Economic Planning and Land Matters, Nigeria, 1980-2006.

The fourth zone is characterized by decreasing residential density of single family dwellings. This zone is for the affluent members of the city, essentially the middle income class, of white collar employees and professional people. To the south eastern periphery of the metropolis is this

high income residential area of Ikoyi. This area was planned in the early 1900's to accommodate the expatriate civil servants. Up till today, it is essentially a high income area for top ranking officers, but houses a mixed population of Nigerians and foreigners. By virtue of its plan and the calibre of its residents, Ikoyi's housing density is very low. Proper layout, good infrastructure and sufficient social amenities are some ingredients that make for high quality of life in this residential area.

Conditions of the residential areas of Apapa, Surulere, Mushin, Bariga and Somolu, which are on the mainland, vary considerably from one another and deviate much from the postulates of any of the three models of urban structure. The eastern portion of Apapa is a high income residential area. The area was planned as a European reservation to house expatriate employees on the Apapa industrial estate at about the same time as Yaba in 1930. On account of this, the area has a low housing density. The area now consists of a mixed population of Nigerians and foreigners.

Areas of recent development are Mushin, Somolu, Bariga, Ogudu and Ikeja (see Figure 2). Mushin, Somolu and Bariga areas due north of Surulere and Yaba respectively exhibit poor residential conditions. This has resulted from the acquisitive nature of private developers. And the population of these areas has

cheaper rates. In order to catch up with the increased demand, many of the houses were poorly designed and lacked essential indoor amenities. However, there are pockets of high quality residential areas, notable among which are the low density areas of Palm Grove Estate, Ajao Estate, Maryland, Gbagada Estate, Ogudu G.R.A. and Ilupeju.

6. CONCLUSION

The paper highlighted the significance and the role of housing in Metropolitan Lagos. It examined the spatial growth and the rapid development of housing in view of the economic and human ecological analyses of urban structures. It was noted that most of the figures contradict assumed rates of growth and projections by the Master Plan Unit of the Ministry of Economic Development and Land Matters. Also, it was observed that the various zones constitute different neighbourhoods and distinct housing markets. However, the models helped in the explanation of the location behaviour of households and groups and offer valuable insights into city structure.

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Fig. 5.1 Built-up Areas of Lagos Metropolis in 1964

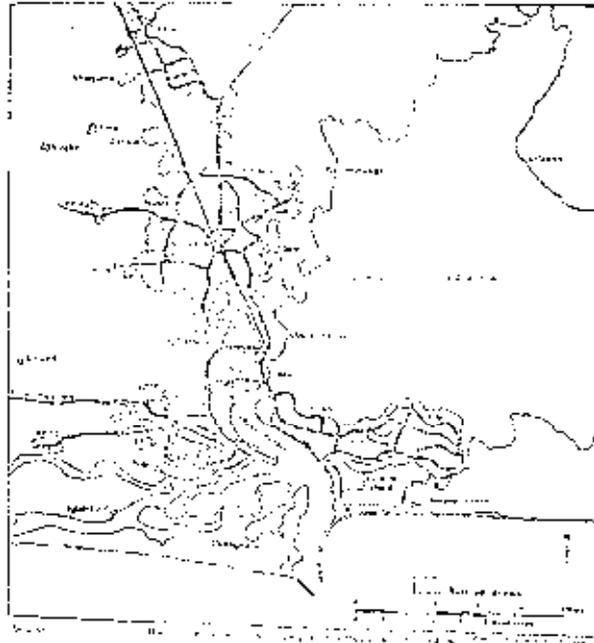
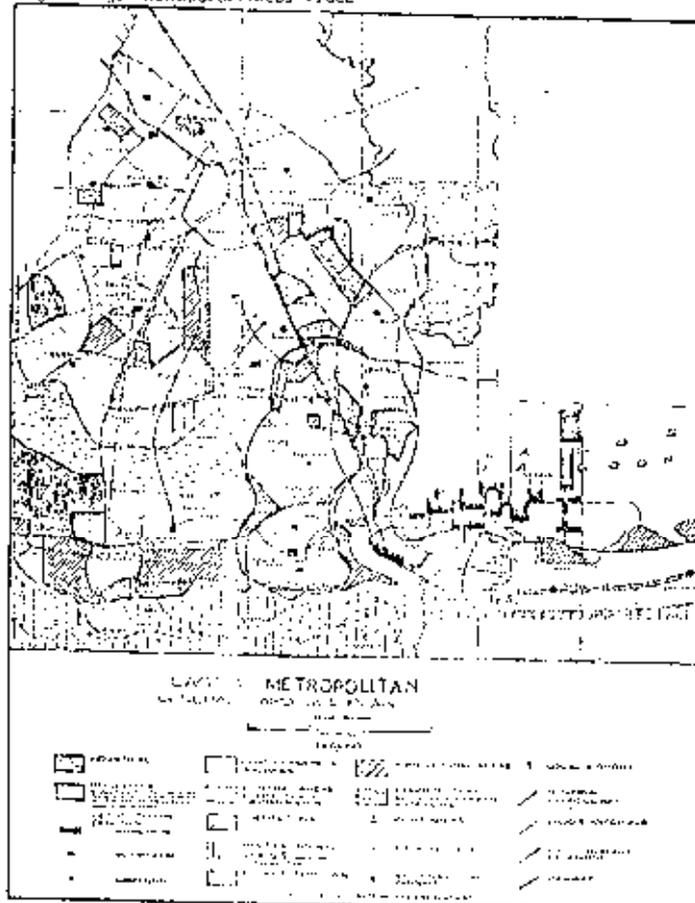


Fig. 5.2 Lagos Metropolitan Areas - 2008



Source: Lagos State Integrated Planning & Development Authority, 2008

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Community participation for housing development

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ABSTRACT

Purpose: The aim of this research is to explore the roles of community participation in the development of housing, as the concept is known to be important over the world. The paper also looks at the barriers to community participation in housing development as well as the role of community participation in housing development.

Methodology/approach: The study is conducted with reference to existing theoretical literature, published and unpublished research. The study is mainly a literature review focused on the concept of community participation in housing development.

Findings: One of the primary findings of this study is that citizens need to build capacity and resources in order to achieve community participation in planning and project development. Also, the study shows that citizen's participation in community development projects does not usually occur by chance, but because certain principles are observed at an acceptable level to the participants and to other stakeholders. Other finding include that Citizens will voluntarily participate in a community activity if they could derive benefit to themselves and the entire community.

Originality: The study explores the concept of community participation, as it is seen as a way for locals to influence development by contributing to project design, influencing public policies and choices, and holding public institutions accountable for the goods and services they provide. The study presents a robust background to the concept of 'community' and 'participation', and on the roles of community participation to development project scheduled to change the lives of the citizens. The paper contributes to this body of knowledge.

Keywords: Community, participation, development, Housing

1. INTRODUCTION

Active community participation is a key to building an empowered community. However, Fleming (2010) alludes that participation does not always lead to empowerment, but it will take a supportive environment in

which to nurture people's aspirations and skills for empowerment to ultimately occur. Community participation is one of the key ingredients of an empowered community. According to Norman (2000), participation is seen as the heart that pumps the community's life blood- its citizens- into the business affairs. It is a principle so important that many countries has made active citizen involvement in all aspects of strategic plan development and implementation a condition for continued participation in it empowerment programs. Community participation is critical to community success and sustainability (Norman, 2000). Community participation is seen by some as a way for stakeholders to influence development by contributing to project design, influencing public policies and choices, and holding public institutions accountable for the goods and services they provide (World Bank, 1996). Still others view community participation as the direct engagement of affected populations in the project cycle, assessment, design, implementation, monitoring and evaluation in a variety of forms. It is also referred to it as an operating philosophy that puts affected populations at the heart of humanitarian and development activities as social actors with insights, competencies, energy and ideas of their own (ALNAP, 2003).

Community can play a variety of roles in the provision and management of housing planning and development. Community participation is a concept that attempts to bring different stakeholders together for problem solving and decision making (Talbot & Verrinder, 2005). It is considered necessary to get community support for housing planning and development (Aref, 2010). It plays an essential role in promoting quality of life according to Putman (2000). Community participation in housing processes can support and uphold local culture, tradition, knowledge and skill, and create pride in community heritage (Lacy et al., 2002). It is one of the processes to empower people to take part in housing development. It is a key concept of development in the 21st century development and projects. Increased participation is a means to achieve development in order to resolve the housing problem that is a major challenge to the majority of the world and most especially to the developing nations. The paper starts out by looking at the meaning of community participation; secondly the meaning of 'community' and 'participation' is decoded to understand the meaning of the concept 'community participation', followed by the barriers to community participation in housing development as well as the role of community participation in housing planning before conclusion is drawn.

2. Community participation

Theories of citizen's participation have received substantial academic attention particularly since the early 1900's, but have been a source of discussion since the 1960s (Justin, 2009). However, the influential theoretical work on the subject of community participation was by Arnstein (1969). The precise importance of Arnstein's work comes from the obvious recognition that there are different levels of participation, from manipulation or therapy of citizens; through to consultation, and to what we might now view as genuine participation, that is the levels of partnership and citizen control. The fundamental theoretical concept in Arnstein's model [is] that

"participation without redistribution of power is an empty and frustrating process for the powerless. It allows the power holders to claim that all sides were considered, but makes it possible for only some of those sides to benefit and to maintain the status quo." Nevertheless, it is vital to understand the meaning of community participation as it has been misused and abused in many projects claiming to have community participation as a project development component. Furthermore, an understanding of the word 'community' and 'participation' individually can best explain the term 'community participation' (discussed in the next section).

The concept of community participation according to McCutcheon (1995) and Ogunfiditimi (2007), originated about 40 years ago out of the community development movement of the late colonial era in parts of Africa and Asia. In the colonial era, "community participation was used as an avenue to improve local welfare, training the local people in administration and extending government control through self-help activities (McCommon, 1993; Ogunfiditimi, 2007; Thwala, 2009). However, the intention of the colonial administrators failed to achieve many of its aims, primarily due to the bureaucratic top-down approach adopted by them (McCommon, 1993; Thwala, 2009). Nonetheless out of these experiences, various methodologies were developed that have been successful and have gained broad support from all major players in the development field (Abbott, 1991). Participation is a rich concept that means different things to different people in different settings. For some, it is a matter of principle; for others, a practice; and for still others, an end in itself.

According to the World Bank (1994) community participation is a system through which the community influences and share control over development initiatives and the decisions and resources that affect them. Community participation entails involving individuals, families and communities in any part of developmental and planning processes of a project. Community participation in housing entails that communities and beneficiaries should be actively involved in interventions to promote development and the reduction of poverty within them through empowerment. The motivation for community participation is not only for people to influence the activities affecting them in relation to housing, but also to meaningfully participate as this will help the communities to build capacity and empower the communities through skill transfer (Ogunfiditimi, 2007; Thwala, 2009). In community participation, people are the central point of development process as emphasis is placed on the development of capacities, skills to enable them negotiate and source materials they require in order to improve their lives (UNDP, 2000).

Community participation can also be defined as the direct involvement of the citizenry in the affairs of planning, governance and overall development programmes at local or grass roots level (Williams, 2006). Likewise, Davidson et al. (2006) informs that it involves how and why members of a community are brought into these affairs. The significance of community participation is said to draw from three main factors. Primarily, it is alleged to allow for cost reduction through the utilisation of local labour and expertise (Davidson et al., 2006). Secondly, it potentially leads to the implementation of appropriate responses through the involvement of locals in collective decision-making, through the assessment of their needs and expectation (Davidson et al., 2006), thus guaranteeing housing satisfaction and other benefits. Thirdly, it helps in directing scarce resources towards the more needy identified by fellow

locals (Davidson et al., 2006; Mayavo, 2002). Thus, community participation is seen as an undertaking that results in the empowerment of the local population. However, it also has numerous non-benevolent political significances, as it is referred to as a curious element in the democratic decision-making process (Mcdowell, 1986). While the roots of community participation can be traced to ancient Greece and colonial New England, its significance reflects a contemporary recognition that societies are simply too remote to be truly “of, by and for the people” without their involvement in the development that affects them (Mcdowell, 1986).

Friedmann (1992) in his work on empowerment, the politics of alternative development, also defined community participation as everybody possessing of his/her own and nobody can interpret it better than that person, which is the reason why development is positioned around people who understand their livelihood better than any other person. The objectives of community participation as an active development process are: empowerment of individuals in the community, building beneficiaries capacity, increase project effectiveness, improve project efficiency and project cost sharing.

3. Understanding ‘community’ and ‘participation’

Young (1990) indicates that there is no universally shared concept of community, but later found out that to most people, it is a small ‘home area’, much smaller than a local authority. Likewise, Sarkissian (2006) informs that defining a ‘community’ more specifically is a hazardous undertaking, that ‘community’ should in itself be seen as a flexible, changeable component in participatory processes. Hence, Wates (2000) defined community in the Community Planning Handbook, as a group of people sharing common interests and living within a geographically defined area. Also, Nabeel and Goethert (1997) in their book, Action Planning for Cities: A Guide to Community Practice, points out that the term community has both “social and spatial dimensions” and that usually the people within a community come together to accomplish a common objective, even if they have certain differences. Nabeel and Goethert further informs that the notion of a community works on the age old philosophies of ‘unity is strength’ and ‘united we stand’. This is because it is believed that a group of people always have advantage over a single individual in getting his or her voice heard, particularly in the case of have-nots of the society. According to Abrams (1971), community can be seen as, “that mythical state of social wholeness in which each member has his place and in which life is regulated by cooperation rather than by competition and conflict”. It is clear that a community generally has two certain elements, that is, physical boundaries and social interests common among the people. On the other hand, a community occasionally may have one element dominating the other, for instant, a community of house wives or a community of painters generally need not belong to the same physical boundaries. In this case, they come together on certain ideological grounds.

Furthermore, Nabeel and Goethert (1997) presented an opposing view that communities are not necessarily always organized and cohesive and sometimes lack the “sense of community” and “social identity”. They explains that for community participatory projects, it is not a necessity to have an already well organized community right from the beginning but the

sense of community can be achieved during the course of the project, which can also be one of the objectives of including community participation in development. Abrams (1971) gives a good illustration of the sense of community in the case of people living in a squatter settlement. Abrams informs that these squatters, living inside the boundaries of the same settlement, have common aims and work together to protect and validate their dwellings. Their existence against the authorities rests upon collaboration among them and hence, the sense of community is fortified by their mutual goals.

Furthermore, Hillery (1955, cited in CAG consultants works on www.cagconsultants.co.uk) also defined community saying that a community "consists of persons in social collaboration within a geographic area and having one or more additional common ties". However, a number of issues are left untouched by this definition though, such as the extent to which the persons concerned need to be aware of the common ties, and the extent to which those ties can change over time. Likewise, it should be noted that in this age of global digital communications, communities are less bound by geography than ever before. In reality, communities are a lot more changeable and complex than the Hillery's definition suggests. Atkinson and Cope (1997) speak of the "fluid and overlapping membership of communities", but the intricacy and close interlacing of communities is perhaps best captured by Etzioni (1993), who submits that "communities are best viewed as if they were Chinese nesting boxes, in which less encompassing communities are nestled within more encompassing ones". However, Burns et al. (1994) informs that "community is not a singular concept but in reality represents a mere umbrella under which shelter a multitude of varying, competing and often conflicting interests".

The word participation can also be referred to as the act of being involved in something according to the Community Planning Handbook by Wates (2000). Likewise, Habraken (2005) informs that participation has two definitions with opposite meaning. Habraken posits that participation can also denote allocating certain vital roles of the development process to the citizens, where they share the decision-making responsibility with the professionals. The other type according to Habraken is where there is no transference of responsibility between citizens and professional, but instead only the opinion of the citizens is considered while making decisions.

Based on the above definitions, it can therefore be inferred that participation can be understood in various ways, depending on the perspective in which it is used. However, Shaeffer (1994) elucidates the different degrees or levels of participation to include: involvement through the contribution of money, materials and labour; involvement through attendance of schedule meetings, implying passive acceptance of decision made by others; involvement through consultation on a particular issue; participation in the delivery of a service, often as a partner with other actors, and participation as implementers of delegated powers and participation in real decision at every stage, including identification of problems, planning, implementation and evaluation according to Uemura (1999). Nevertheless, Shaeffer emphasized that the first four levels use the word involvement and suggest essentially a passive collaboration, while the last three items use the active role (Uemura, 1999).

Furthermore, participation is mainly concern with human development and increases citizens sense of control over issues which affect their lives in the case of housing development, helps to learn how to

plan and implement and, on a broader front, prepares them for participation at regional or even national level (Aref, 2010). In principle, participation in housing development is a good thing because it eliminates citizen's isolation and sets the groundwork for them to have not only a more significant influence on their housing development, but also on creating great independence, such as the transfer of skills in self-help housing development, where citizens are trained in different building trades and empowered to have a control over their lives (Arfe, 2010; Oakley 1991; Thwala, 2009). Without community participation, there is apparently no partnership, no development and no program. Therefore, the absence of community participation in decision-making to implement housing development can lead to failure in the community development initiative (Miranda, 2007; Ogunfiditimi, 2007). There exist different levels of participation in a typical development project, such as manipulation (Arnstein, 1969); informing (Arnstein, 1969; Wilcox, 1999); consultation (Arnstein, 1969; Burns et al., 1994; Wilcox, 1999); interaction (Pretty, 1995); partnership (Arnstein, 1969; Burns et al., 1994; Wilcox, 1999), and empowerment (Choguill, 1996; Dewar, 1999).

4. Research methodology

The research was conducted with reference to existing theoretical literature, published and unpublished literatures. The study is mainly a literature survey/review and looks at the roles of community participation in the development of housing, as the concept is known to be important over the world. The paper also looks at the barriers to community participation in housing development as well as the role of community participation in housing planning.

5. Barriers to community participation in housing

In addition to identifying the usefulness of community participation, it is equally importance to recognize some of the problems involved in participatory development approaches. An understanding of the barriers can help community and others who lead organisation more effectively impact the housing development policy-making process. Overcoming the barriers to housing development will serve to facilitate the policy making process and thus the overall citizen's meaningful participation in the housing development process.

When participation is used as an end to development process, it becomes a time-consuming process and since time is directly proportional to money in development projects, it will be quite difficult to justify such an approach (Moatasim, 2005) as the process will escalate the overall project cost. Moreover, there is fear amongst government of uncontrolled empowerment of people and lack of trust in their ability to make informed decisions, which prevent governments to change their paternalistic approach in decision-making according to Moatasim (ibid). The only way to overcome this is to look at participation from a wider perspective and by measuring its benefits against the limitations. Though, it takes more time for a fully participatory development project to achieve its goals, but the end result in the form of community empowerment goes a long way. Other

barriers that can be faced include: stakeholders forgoing genuine participation, due to political and social pressures to show that the development process is advancing; lack of support by the community for the development project because of limited involvement of the community, particularly the affected community, in planning and design; failing to understand the complexity of community involvement and believing that the community is a united, organised body; disregarding how the community is already structured when introducing participatory activities and underestimation of the time and cost of genuine participatory processes amongst others.

However, one other paramount barrier to participation is the lack of feedback to the concerned community. For community participants, taking part is a time and energy-consuming process. But all too often, communities never find out what difference their efforts have made in the development process (Davy, 2006). Where people hear nothing about the impact of their work, they are unlikely to feel that they have been treated as partners in the project, or with the respect they are worthy of. This is because "People are not stupid. They know that they will not always get everything they want. But they do expect to know what difference their participation has made, and if they are not informed of the difference their participation has made, they assume it has not made any effect". Once decisions are made and implementation begins, stakeholders and others involved move on to other work. Most times, no-one is left with the responsibility for providing feedback to communities. Also, an unfair distribution of work amongst members of the community can be a great barrier to effective community participation. Likewise, some members in the community may feel that they are asked to take on extra work tasks that provide them little financial/social or other incentives; a highly individualistic, movement oriented society (Snel, n.d.). Individuals may not feel a sense of community and thereby question the purpose of their involvement in a development project; the feeling that the government should provide the facilities for them, will thus makes the community feel that the development project is simply another way of exploiting people.

6. The purpose of participation in development

Community participation is seen as a way for stakeholders to effect development by contributing to project design, influencing public choices, and holding public institutions accountable for the goods and services they provide to them (World Bank, 1996). Likewise, others view participation as the direct engagement of affected populations in the project development cycle, such as assessment, design, implementation, monitoring, and evaluation in a variety of forms. Still others consider participation as an operational philosophy that puts affected populations at the core of humanitarian and development activities as social actors with insights, competencies, energy, and ideas of their own (ALNAP, 2003).

According to World Bank (1996), participation allows stakeholders to collaboratively carry out a number of activities in the development cycle, including the following: analysing, that is, identifying the strengths and weaknesses of existing policies and service and support systems; setting objectives- deciding and articulating what is needed; creating strategy such as deciding, in pragmatic terms, directions, priorities, and institutional

responsibilities; formulating tactics- developing or overseeing the development of project policies, specifications, blueprints, budgets, and technologies needed to move from the present to the future and monitoring, which encompasses conducting social assessments or other forms of monitoring of project expenditures and outputs (World Bank, 2006). Participation is also known to have roles that are social in nature, such as empowering individuals, increasing local capacity, strengthening democratic processes, and giving voice to the marginalized and disadvantaged communities and groups (World Bank, *ibid*). Another set of roles has to do with program effectiveness and leverage: creating a sense of ownership, improving program quality, mobilizing resources, and stimulating community involvement in execution.

7. The Importance of Citizen Participation

Community participation can be seen from the viewpoint of benefits to be gained and costs to be borne. Implicit in this "penchant for getting involved" is the notion of the relationship between self and society (Snel, n.d.). Most times, participation on volunteer groups is an important science for individual's definitions of self-esteem and self-identity in development that concerned them, mostly when they have been neglected for so long.

Participatory groups function as links between individuals and larger societal structures (Kornhauser 1959) with every member of the group seeking a common good. Most times participants ask themselves what are the benefits that will accrue to them in the process? Bridges (1974) states five advantages to be gained from active participation in community development programme like housing development: the citizen can bring about desired change by expressing one's desire, either individually or through a community group; the individual learns how to make desired changes in their own lives through what they have learnt from the process; the citizen learns to understand and appreciate the individual needs and interests of all community groups thereby forging a common good for themselves; they also learn how to resolve conflicting interests for the general welfare of the group, the individual begins to understand group dynamics as it applies to mixed groups.

Heberlein (1976) informs that public involvement usually results in better decisions. This he argues that community decisions that involve citizens are more likely to be acceptable to the local people because better community decisions, by definition, should be beneficial to the average citizen. Citizen participation in development also serves to check and balance political activities. Also, participation allows fuller access to the benefits of a democratic society. Cahn and Camper (1968) propose three basic motivations for community participation in development. First, they propose that merely knowing that one can participate promotes dignity and self-sufficiency within the individual. Second, it taps the dynamisms and resources of individual citizens within the community. Finally, participation provides a cradle of special insight, information, knowledge, and experience, which contributes to the soundness of community solutions. The result is an emphasis on problem solving to eliminate deficiencies in the community (Christensen & Robinson 1980).

Cook (1975) notes that community participation in development can legitimize a program, its plans, actions, and leadership. To legitimize

can often mean the difference between success and failure of community efforts. Unsupported leaders often become discouraged and drop activities that are potentially beneficial to community residents. Community participation can also reduce the cost for personnel needed to carry out many of the duties associated with community action. Without this support, scores of worthwhile projects would never be achieved in many communities (Snel, n.d.). In summary, decision making that is delegated by others will not always be in the best interest of an individual and his or her neighbours. Community development is a direct product of citizen involvement and empowerment.

8. Conclusion

The article start out by looking at the meaning of community participation; secondly the meaning of 'community' and 'participation' is decoded to understand the meaning of the concept 'community participation', followed by the barriers to community participation in housing development as well as the role of community participation in housing development. In conclusion, in order to promote community participation for housing development, it is necessary to always assess the communities' capacity to carry out what they are expected to achieve in a long run. From the literature, community participation is a goal in housing development informed by the government to the disadvantage group, as an avenue to solve complicated issues contributing to poor housing development and the promotion of empowerment to the community.

Thus, Citizen Participation in housing development projects does not usually occur by chance alone. It happens because certain principles are observed at an acceptable level to the participants. Citizens will voluntarily participate in a housing development when they see positive benefits to be gained; have an appropriate organizational structure available to them for expressing their interests; see some aspect of their way-of-life threatened; feel committed to be supportive of the activity; have better knowledge of an issue or situation and when they feel comfortable in the group. Further, citizen participation in any housing development can be improved by: stressing participation benefits; organizing or identifying appropriate groups receptive to citizen input; helping citizens find positive ways to respond to threatening situations; stressing obligations of each participants toward community improvement; providing citizens with better knowledge on issues and opportunities and helping participants feel comfortable within the development group.

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Alleviating Housing Challenges in Nigeria

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ABSTRACT

Purpose: Anecdotal evidence suggests that in spite of its natural endowments, Nigeria continue to face housing shortages with almost 70% of urban dwellers living in slums. Therefore, the intent of the research is to identify construction related problems in the delivery of low cost housing in Nigeria.

Design / Methodology / Approach: The key issue here is the inadequacies relative to housing delivery in Nigeria. Relying on data generated through a mixed-methods empirical investigation conducted in Minna, a major city in Northern Nigeria, the paper reports on housing challenges in terms of quality from the perspective of housing stakeholders.

Findings: Finding arising from the study indicates that there is major scope for improving housing delivery in Nigeria. The study reveals that housing delivery mechanism is under-performing, the quality of houses is suspect, and housing occupants are generally not significantly satisfied with the situation.

Practical implications: The inability of socio-economic developments in sub-Sahara Africa to keep pace with population growth in the region have created situations whereby urban slums are now increasing in major cities (UN-HABITAT, 2009). Hence, the research findings recommends policy shift with respect to affordable housing in terms of design and construction as the United Nations (2010) recently reported that sub-Saharan Africa account for the highest prevalence of urban slums in spite of efforts under way in the region to combat housing shortages.

Originality / Value: The research highlight issues relative to the provision of affordable housing, which is a national imperative for Nigeria that is reportedly the most populous nation in Africa.

KEYWORDS: Construction, Design, Housing, Nigeria

1. INTRODUCTION

Housing represents one of the most basic human needs and has a profound impact on the health, welfare, social attitudes and economic productivity of the individual. It is also one of the veritable indicators of a country's standard of living and to some extent a status symbol in the society. Yet, in spite of the essential role-played by housing, countries all over the world are still experiencing shortages in one form or the other though the enormity and complexity are more in the developing countries (Mitlin, 2001; Keivani and Werna, 2001; Sivam and Karuppanan, 2002). United Nations Population Fund (UNFPA, 2007) stated that in 2008, the world would reach an invisible but momentous milestone; for the first time in history, more than half its human population, 3.3 billion people, would be living in urban areas. By 2030, this figure is expected to increase to almost 5 billion. Many of the new urbanites will be poor.

The future of cities according to UNFPA (2007) in developing countries, the future of humanity itself, all depend very much on decisions made at present in preparation for this growth. Between 2000 and 2030, Asia's urban population will increase from 1.36 billion to 2.64 billion, Africa's from 294 million to 742 million, and that of Latin America and the Caribbean from 394 million to 609 million (UNFPA, 2007). One of the decisions to be made is how will the population be housed?

Around the world, no nation can claim to have solved the housing problem of their people as shown by various authors reported that highlighted various countries related housing issues. The following examples illustrate the housing shortages that prevail:

- In Ethiopia, the Ministry of Works and Housing (2008) stated that studies made in the last five years concluded that a housing shortage of between 900,000-1,000,000 in urban centres and only 30% of the existing urban housing stock is in good or fair condition.
- For the Metropolitan Region of Sao Paulo (MRSP), the urban housing deficit is approximately 611,936 units (UN-Habitat, 2010).
- The housing shortage in Nigeria is estimated to affect between 14 and 16 million people (UN-Habitat, 2008a). Mabogunje (cited by Kabir and Bustani, 2009) indicated that R600billion (N12trillion; Nigerian naira) will be required to finance the housing deficit.
- For Pakistan, in 2008, the yearly estimated housing demand was 570,000 units. Actual supply was 300,000 units, leaving a shortfall of 270,000 units every year. The consequence of this situation is that almost half of the total urban population now lives in squatters or informal settlements (ICA, 2009_a).
- In the year 2007, the housing deficit in India was estimated to be 24.7 million houses in urban areas and 15.95 million houses in rural areas, totalling 40.65 million units (ICA, 2009_b).
- Bellal (2009) emphasised that the burden of cumulated housing shortage in Algeria is still high and it is expected to reach nearly 2 million dwellings by 2025 but was estimated at 763,176; 994,357 in 2010 with a population of 33.8 million in 2007.

- In Mexico, *Centro de Investigacion Documentacion de la Casa* (CIDOC) and *Sociedad Hipotecaria Federal* (SHF) (2006) established that 1.8 million new housing and 2.7 million housing improvements are needed in a country with a population of 103.3 million people.
- In Kenya, Government of Kenya GoK (cited by Alder and Munene, 2001) showed that the country has a deficit of 127,700 in urban and 303,600 in rural areas.
- In Uganda, Byaruhanga (2001) puts the deficit at 270,000 with a population of 21.6 million people.
- In South Africa, in spite of the delivery of 2.8 million houses in 2010, the backlog was put at 2.1 million in 2010 (Sexwale, 2010; Zuma, 2010)

The above mentioned situation calls for concern. This is reflected by Tibaijuka (2005) who stated that the need for housing production in developing country cities is estimated at around 35 million per year. Breaking this figure down, Tibaijuka added that some 20 million units are required to meet demographic growth and new household formation, while the remaining 15 million units are to meet the requirements of the homeless and people living in inadequate housing. Summing this up, some 95,000 new urban housing units are needed to be constructed each day to ensure acceptable housing conditions. Oruwari (2006) emphasised that globally the housing conditions of the poor are deteriorating with the developing world accounting for the worst rate of deterioration. Approximately 998 million people were living in slums in 2007; the projection for 2010 was 1.12 billion people (UN-Habitat, 2007). These figures indicate that the housing challenge is large.

Housing in Nigeria

The housing situation in Nigeria as stated by Alkali (2005) is one of inadequacy both in quality and quantity and that there is a wide gap that exists between expectation and the capability of realization. The percentage of Nigerians living in urban centres according to Okupe (cited by Kabir and Bustani, 2008) has increased over the years; from 7% in the 1930s to 35% in the 1990s. The resultant effect is that houses in these areas will be put under considerable pressure. Achunine (1993) asserted that the situation is particularly serious in developing countries where population growth and urbanization are increasing very rapidly and where the gap between housing need and supply is greatest. This situation remains so, because housing has typically been regarded as something to be relegated to the background in the family of projects that constitutes development programmes.

Mosaku (1997) opined that this situation may persist for a very long time to come unless the right things are done to ensure consistent policies on matters affecting adequate provision, and equitable distribution of housing. Hitherto, solutions to housing shortage have been spontaneous and equitable distribution of available houses has been on the basis of some spurious factors, which are indefensible, and in conflict with both social and economic policy objectives.

According to Gumel (2000) the provision of housing for human habitation encompasses the physical structure in addition to the immediate surrounding environment, which includes social and utility services that goes along to make a community a liveable environment. It is observed that the yearnings of the citizenry for housing have been on the increase because of the steady increase in population.

To all intents and purposes, past governments of Nigeria cannot be said to have ignored housing in the national development efforts. The emphasis and implementation may be weak, but past governments have shown some commitments to housing matters. These have been reported by various authors (for example, Sanusi 1998, Adeyemo and Dekolo 2000, Gumel 2000, Olusanya 2000, Omuojine 2000, and Federal Government of Nigeria, 2004, Aigbavboa and Thwala 2009). In spite of the efforts of various stakeholders such as individuals, private developers and the Nigerian Government to provide adequate housing, there are still numerous challenges besetting these efforts as highlighted by the following authors:

- Onukwugha (2000) cited
- Limited use of co-operative housing approach as one of the challenges facing delivery of adequate housing for the populace.
- Jinadu (2004) stated that the following factors are the causes of housing inadequacy
- High cost of building materials,
- Inadequate housing statistics for proper planning,
- Institutional challenges and
- Low housing investment.
- Mabogunje (cited by Ademiluyi and Raji, 2008) indicated that the following are the factors responsible for the inadequate housing delivery:
 - Land acquisition difficulties,
 - Inability to access long term mortgage finance and
 - High cost of building material.
- Jimoh and Olayiwola (2008) were of the opinion that disproportionate number of Professional Builders (less than 2000) relative to the population of Nigeria (more than 120 million) contributes indirectly to the inadequate delivery of housing.
- Aigbavboa and Thwala (2009) established the following factors as being responsible for the inadequate housing delivery experienced in Nigeria:
 - Legislation
 - Contracts enforcement
 - Inadequate infrastructure
 - Macroeconomic environment that is unstable and
 - Lacklustre implementation of the National Housing Policy.

- Finally, the following 2 factors may be added to the list of challenges in addition to those mentioned by the above authors:
- High interest rates charged by banks for loans and
- Concentration of Primary Mortgage Institutions (PMIs) in urban centres such as Lagos and Abuja.

It is with the above in mind that the study on alleviating housing challenges in Nikamgbe a suburb of Minna-Nigeria was undertaken.

2. THE RESEARCH

Nikamgbe was chosen for 2 reasons; the proximity to National Institutions (a Federal University and Headquarters of an Examination Council) and the rapid development of the area. It should be noted that the Federal University moved to the present site in 2005 while the Examination Council moved to its site in 2010 hence the rapid development experienced in the area. As at the time of the study, 15 employees of the University had built their own houses and these employees formed the respondents of the structured questionnaires administered. Questionnaire was also administered to the employee in-charge of Enforcement in Niger State Urban Development Board (NUDB) Minna, a body responsible for the monitoring and implementing of Planning Laws in Minna.

In addition to the above, an employee of the State Ministry of Land was interviewed (unstructured interview) to know the duration and fee paid for the approval of Right of Occupancy and Certificate of Occupancy (C of O). This was done to complement the response from the NUDB. In essence, the methodology adopted was mixed methods through the administration of questionnaires and unstructured interview which added impetus to the survey.

It is notable that all the questionnaires were completed and returned, which equates to a 100% response rate.

As indicated in Table 55.1, it normally takes 2 weeks for approval to be given when all the documents handed in at the NUDB are correct on payment of R750 (N15, 000 Nigerian money) to process for example a 3-bedroom apartment. One of the requirements to be met is the submission of the Right of Occupancy along side other title drawings.

To obtain the Right of Occupancy, a prospective home owner is expected to provide a processing fee of R1000 for residential purpose and R2500 to get a piece of land surveyed. It is when the above conditions have been met that the processing of the Right of Occupancy can begin. Obtaining the Right of Occupancy may take from 3 months to 12 months. This Right of Occupancy allows the owner to occupy the land for a period of ninety-nine years as all land belongs to the Government. Of note is that the Right of Occupancy cannot be used as collateral in banks to obtain loans. For a prospective home owner to wait for close to one year before approval can be given is demoralising to say the least.

A different land title instrument called Certificate of Occupancy takes a longer time to be processed as it is only the Governor of a State that can

sign it. The fee payable depends on when one's Right of Occupancy was issued. This can be used as collateral in banks to obtain loans.

For eight people to enforce compliance of development control laws in a town of over hundred thousand inhabitants is near impossible, this may not be unconnected with houses springing up at random without adequate approval from NUDB. Though there have been instances of demolition of illegal structures, people are still not deterred.

As indicated earlier a quantitative survey was conducted among home owners in Minna, Nigeria. To this end, Table 55.2 indicates the respondents' perception of their level of satisfaction with the performance with respect to quality of their low cost houses in terms of percentage responses to scale of 1 (low) to 5 (high), and a mean score (MS) ranging between 1.00 and 5.00. It is notable that the MS recorded is above the midpoint score of 3.00, which indicate that in general the respondent' level of satisfaction can be deemed to be more of high as opposed to low.

Table 55.2 Home owner level of satisfaction with the quality of their houses

Unsure	Response %					MS	
	Low High	1	2	3	4		5
0.0		7.7	7.7	46.2	38.5	0.0	3.15

Table 55.1 Summary of results from NUDB & unstructured interview with employee of the State Ministry of Lands.

Requirements for approval of title drawings	Duration before approval	Fee paid	Staff strength in monitoring & enforcement unit	Challenges faced in carrying out its functions	The way forward	Certificate of Occupancy approval (C of O)	Fee paid
Submission of title documents such as Architectural, Structural, Electrical & Mechanical drawings. Submission of Right of Occupancy. Submission of Environmental Impact Assessment (EIA) report for large projects such as Housing Estate.	2 weeks	Fees differ with differing development purposes.	8 members	Lack of adequate machinery & logistics. Lack of interest and inability by government to carry out renewals/redevelopment in blighted neighbourhood. Adequate compensation not paid on Designed Government Schemes leading to distortion of such schemes. Illiteracy and ignorance of the general public.	Government should be proactive. Review of Planning Policies. Adequate & prompt payment of compensation. Government should encourage public participation in Planning process. Elimination of lengthy bureaucratic process during approvals.	The processing can only begin when the Right of Occupancy has been obtained from the Lands Ministry. It is the Governor of the State that signs this. It may take more than one year to get the C of O	The fee paid is predicated on the year the Right of Occupancy was obtained. For a residential area, this is R500/year (N10,000 Nigerian money)

Source: Authors' fieldwork, 2010

Perhaps based on the perceptions expressed in Table 55.2, Table 55.3 indicates that in general the respondents are not so dissatisfied with the occurrence of a range of issues that are relative to their low cost houses. However, Table 3 indicates that the respondents perceive that the loss of confidence in government can be deemed worrisome to them (MS= 2.60).

Table 55.3 Extent of home owners' dissatisfaction with quality related aspects

Aspect	Response %						MS	RANK
	Unsure	Never Always						
		1	2	3	4	5		
Loss of confidence in government	16.7	16.7	25.0	16.7	25.0	0.0	2.60	1
High maintenance cost	26.7	26.7	33.3	13.3	0.0	0.0	1.82	2
Conflicts with builders / masons	13.3	46.7	33.3	6.7	0.0	0.0	1.54	3
Domestic related stress	13.3	46.7	33.3	6.7	0.0	0.0	1.54	4
Damage to the environment	26.7	46.7	20.0	6.7	0.0	0.0	1.45	5
Constant reconstruction	20.0	60.0	20.0	0.0	0.0	0.0	1.25	6
Domestic Incidents and accidents	20.0	66.7	6.7	6.7	0.0	0.0	1.25	7
Abandonment and relocation	38.5	61.5	0.0	0.0	0.0	0.0	1.00	8

In addition, the relative satisfaction level reported by the respondents may also be due to the fact that most of the home owners built their houses themselves (64.3%), and or used the services of registered builders (28.6%) as indicated in Table 55.4. Not only that, it may also be due to the fact that majority of the respondents financed the construction of their houses through non-governmental sources or high credit facilities from banks. Specifically, the research indicates that:

- 13.3 % of the respondents financed the construction of their houses through personal savings alone;
- 13.3% of the respondents financed the construction of their houses through cooperative contributions alone;
- 13.3% of the respondents financed the construction of their houses through combined personal savings and cooperative contributions sources;
- 26.7% of the respondents utilised personal savings, cooperative contributions and bank loans for financing the construction of their houses, and
- 20% of the respondents financed the construction of their houses through personal savings and bank savings.

Table 55.4 The trade that supervised the construction

Response %			
Registered Builder	Mason	General Foreman	Self:
28.6	0.0	7.1	64.3
of low cost house			

To be succinct, the respondents general comment to the survey suggest that they perceive that the lack of access to mortgage facilities; quality of materials in terms of finishes; and a general lack of experienced registered builders marginalises the realisation of high quality low cost houses in Nigeria.

4. CONCLUSIONS

In general, it is apparent from the above mentioned research findings that all is not well with the procurement of low income houses in Minna, Nigeria. Though, the respondents opined that in general, they are satisfied with the quality of their homes, the mere fact that majority of them built the houses and the fact the MS (3.15), indicate that there is a reason to be concerned about the quality of low cost houses built in Minna Nigeria.

As rightly suggested by the respondents, government intervention and the availability of credit facility tailored to the needs of low income earner will go along way in alleviating the bottlenecks associated with low cost houses in Nigeria. There is the need for the Federal Mortgage Bank of Nigeria to be further capacitated by the Federal Government in order to expand its operations. In addition to this, the Primary Mortgage Institutions should be incentivised by the Federal Government so that their impact can be felt not only in urban centres as is this case presently but in major towns around the country. Financing instruments beneficial to the low income earners be promoted by the financial institutions as a way of corporate social responsibility.

A situation where it is the Governor that can sign a C of O portends serious problem for housing development, hence efforts should be made to demystify this so that vast majority of people can aspire to have the C of O instead of the Right of Occupancy as is the case now with many home owners.

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The Effects of Stringent Lending Criteria on the Residential Property Market

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ABSTRACT

Purpose of this paper: The research aimed to discover if stringent lending criteria were contributing to a decrease in activity in the residential property market.

Design/methodology/approach: A quantitative method of research was selected which involved data collection with the use of two structured questionnaires.

Findings: Research findings indicate that the increased stringency of lending criteria caused a 24% reduction in First Time Buyers (FTB's), and a 26% reduction in Buy-to-let (BTL) investors.

Research limitations/implications: This research only considered estate agents and home loan consultants in the Nelson Mandela Metropolitan area. Further research may include increased target populations of estate agents and home loan consultants to be more representative of the South African residential property market.

This research only considered the effects of stringent lending criteria on two sub-groups of residential property buyers, namely FTB's and BTL investors. Further research may include other sub-groups of residential property buyers as well as other property markets, for example, the commercial property market.

Original/value: This study is of value to the property industry as it will contribute to a better understanding of how the provision of finance affects the residential property market. In addition, the study may also offer

guidance to professionals and the general public on ways to obtain housing finance or predict possible investment opportunities in the market.

KEYWORDS: Stringent Lending Criteria, National Credit Act, Act 34 of 2005 (NCA), Residential Property Market, First Time Buyers (FTB's), Buy-to-let (BTL) investors.

1. INTRODUCTION

South Africa (SA) has experienced a significant decline in the residential property market since June 2007. The decline could be blamed on four factors which include the introduction of the National Credit Act (NCA), Act 34 of 2005 (which has caused an increase in the stringency of lending criteria), the global financial crisis, high interest rates and the high cost of transfer duty (Theunissen, 2007).

Stringent lending criteria is a tactic used by lenders to stop "automatic cruise control" financing and tighten mortgage lending criteria during property market downturns and general economic recessions. Lenders do this as they have to take their own equity and survival into consideration. In doing so, it may be possible to reduce housing demand and housing prices significantly. However, one can argue that during a financial crisis, the last thing anyone needs is for the property market to crash (Lunde, 2008).

If it was just a case of financial institutions covering themselves, the market would have seen significant increases when the interest rates were lowered, as this was a direct tactic employed by the Reserve Bank to increase investment in property (Lunde, 2008).

2. RESIDENTIAL PROPERTY FINANCE

Housing finance is extremely important as the asset it finances, housing, accounts for a large percentage of the national wealth, fixed capital stock and the wealth of most households. Therefore, the ability to efficiently finance such an important component of the economic system will have a significant effect on overall levels of investment and growth (Buckley, Chiquier & Lea, 2009).

There is a sophisticated and effective housing finance system for the middle and upper income segments of the housing market. (International Union for housing Finance (IUHF), 2005).

The total value of residential mortgage loans and re-advances granted for residential dwellings decreased from R364 billion at the end of 2007 to R189 billion by the end of 2009 (SARB, 2010A). According to SARB (2010B), the downward phase of the current credit cycle, which started in the second half of 2007, has been one of the longest in recorded history. Possible causes of this decrease might be attributed to mounting levels of debt and mortgage defaults, coupled to stricter lending criteria introduced by the NCA, leaving banks with no choice but to be more circumspect in granting new loans (Kleynhans, 2009A).

Geffen (2009) stated that it is definitely much harder for buyers to obtain home loan approvals, as banks now require large deposits and are very cautious with regard to new lending. Geffen (2008) further stated that more than 50% of home loan applications in June 2008 were rejected by the banks. However, one third of the applicants rejected by one bank were approved by another.

Joubert (2009) stated that up to 70% of bond applicants were being denied finance and that unsuccessful credit applications often have less to do with affordability than with lending criteria.

In addition to the reduced amount of finance approvals, there has been a reduction in the value that the loan makes up of the total property price (Geffen, 2010). Prior to the implementation of the NCA, banks were lending up to 108% of loan-to-value, but this was reduced to between 70% and 80% after the credit crisis. More recently there is evidence that 100% loans are again on offer. Lawrence (2010A) states that on average only 3% to 5% of all bond applications for 100% bonds have proved successful, whereas in the past over 40% of applications for 100% bonds were successful.

Lending criteria are extremely important to financial institutions as lenders run a risk providing loans for residential properties; even though this risk is significantly lower than on ordinary loans. By using the property as collateral, the lender's potential for loss on a mortgage is greatly reduced as only part of the outstanding debt will be lost if the property is forced into foreclosure or repossessed. However, if several years of falling house prices occur in succession, losses will accumulate to threaten the lender's equity (Lunde, 2008).

According to Lunde (2008), mortgage lending is one of the major sources of banking difficulties, and indirectly of financial vulnerability for the wider economy. The instability in the market is aggravated by the behaviour of lenders. Although lenders run these risks, they find lending attractive because:

- Collateral gives the lender higher security and makes it possible to reduce the interest rates on the loans. The borrower pays for this reduction by selling an option to give up the property if they cannot keep up with the repayments on the loan.
- Property loans generate large initial fees that boost profits immediately, this helps financial institutions grow relatively quickly.

The NCA came into effect on 1 June 2007. Two core aims of the NCA are to protect the consumer from being granted credit recklessly and create a fair and non-discriminatory credit market. The NCA has curbed reckless lending and has generally reduced over-indebtedness across the population by regulating the requirement for lenders to consider the consumer's overall financial commitments before granting additional debt. Although the NCA was successful in fulfilling its objectives, it has gone further and limited access to finance, especially in the lower income sectors (Cook, Masinda, Kaka, Backman, Molapisane & Dlamini, 2009). Cook et al (2009) state that this has happened in two ways:

Firstly, the requirements of the NCA were applied by lenders as an additional requirement over the pre-existing credit models. Usually these models dictated that no more than 30% of a consumer's gross income could be committed to the monthly installments of a loan. Subsequent to

the implementation of the NCA, lenders also considered whether the installments could be afforded considering the income and expenses of the consumer. It is in this way of application that the NCA requirement became an additional constraint. Lenders do not grant credit to a person whose monthly installment exceeds 30% of their gross monthly income even if they qualify in terms of the income and expenditure assessment. The latest jargon word in the industry, since the implementation of the NCA, is Available Disposable Income (ADI). ADI is determined by subtracting your Contractual Obligations and Expenses from your Net Income. An individual's (Cook et al, 2009).

Secondly, the income and expenditure assessment is skewed in favour of high income earners that have more disposable income.

Various sub-groups have been more affected than others by the newly imposed stringent lending criteria and as stated earlier, it is definitely more ruthless on the less affluent. However, the most affected sub-groups seem to be FTB's and self-employed individuals.

According to Loos (2010B), FTB's are a low savings group even by the weak South African standards. According to Goslett (2010) the banks' lending criteria have become increasingly stringent, and in particular, deposit requirements have remained high. Some banks have adopted policies of only awarding bonds at a 70% loan-to-value. These two statements might explain why FTB's are finding it increasingly difficult to enter the property market. However, Townes (2008) adds that FTB's are struggling to enter the market due to high interest rates and the NCA's tougher restrictions, which effectively disqualifies them from raising sufficient bond finance.

According to Doig (2010), banks in SA are even more cautious about lending money to self-employed individuals and will demand a full financial statement from anyone that owns more than 25% of the company that employs them. Doig (2010) states that in 2008 a hefty 9 779 companies were liquidated and 11 946 individuals and partnerships become insolvent. Doig (2010) believes it is these statistics that provide a clear indication of why banks are being that much tougher about lending money. Contrary to this Lawrence (2010B) states that a possible reason could be that the NCA places great emphasis on indisputable proof of income. If banks have acted without this they run the risk of being charged with reckless lending and the penalties for this are extremely severe.

3. THE RESIDENTIAL PROPERTY MARKET

Prinsloo & Prinsloo (2004) defines the demand for residential property as the desire and need joined with the ability and willingness to spend. The law of demand states that the lower the price the higher the demand and vice versa. The demand for housing is influenced by five major factors which are:

- The population;
- Their effective income;
- Their housing likes and dislikes – including preferences, taste or choice;
- The amount of credit available; and

- The effect of advertising.

There are two housing markets in South Africa: the low-income market and the mainstream market. The more sophisticated mainstream market has been performing well (IUHF, 2004). South Africa's property market has consistently outperformed every other property market in the world for the past 13 years as house prices have increased by 456% over that period (Gilmour, 2010).

By reviewing the graphs of the ABSA house price index (Du Toit, 2010A), the FNB house price index (Loos & Kellerman, 2010A), and the Standard Bank house price index (Botha, 2010), it is evident that from 2005 the percentage of house price growth began to decrease but only reached negative growth in approximately the start of the second quarter of 2008. Negative growth was experienced until approximately the start of the fourth quarter of 2009.

South African house prices steadily improved since bottoming out in 2009. However, the pace of acceleration in the average price of domestic residential property started moderating from the middle of 2010 which indicates that house price inflation may have been peaking. The growth from 2009 was partly as a result of the stimulus from the large reduction in interest rate basis point since December 2008 and easier lending criteria adopted by banks (SARB, 2010B). However, SARB (2010B) predicted that the property market will continue to be affected by the affordability of houses, which remains under pressure along with high levels of household debt and unemployment.

Two important sub-groups of buyers identified in the "FNB Residential Property Barometer", a quarterly estate agent survey conducted by FNB, are FTB's and BTL investors.

By reviewing the statistics and graphs of FTB Activity in the residential property market published in the FNB Residential Property Market (Loos & Kellerman, 2010B), it is clear that the percentage of FTB's has decreased substantially since the start of the survey in 2004. Prior to the implementation of the NCA in June 2007, FTB's contributed approximately 25% to the total activity in the market. During 2007 there is a clear and distinct drop in the percentage FTB's contribute to demand and on average it seems as if FTB's contribute approximately 15% to the total activity in the market. Illustrating a drop of about 40% in the contribution FTB's make to the total activity in the market.

Since 2005 the presence of BTL investors in the Residential property market has dwindled. According to Loos & Kellerman (2010C), BTL buying dropped to 9% of total buying in the first quarter of 2010, which was the lowest percentage achieved on the FNB Property Barometer since the survey started in 2004. At some points in the past BTL investors made up 25% of the total. This signifies that the proportion of activity that BTL investors contribute to the total amount of activity in the market has decreased by approximately 64% since the implementation of the NCA.

As stated earlier, by Theunissen (2007), a number of economic factors have been said to have contributed to the underperforming residential property market. These factors included the effect of the NCA, rising interest rates, a slowing economy and a lack of further transfer duty relief. In December 2008 the worst of the economic crisis was over even though decreased disposable income, strict bank lending criteria, unstable global economic conditions, high debt ratios and socio-political insecurity would all

continue to make for difficult conditions in the market (Schultheiss, 2008). However, Schultheiss (2008) stated that further interest rate cuts would stimulate the property market.

By reviewing the Dates of Change in the Repurchase (Repo) Rate available provided by SARB (2010D), it can be seen that the Repo Rate has dropped 600 basis points since June 2008. In June 2008 the Repo rate was 12%, the latest drop was in October 2010 which put the Repo Rate at 6%, and this was the lowest it had been for ten years.

Loos (2010C) state that the residential property market is strongly credit-driven, and thus heavily reliant on interest rate moves, but that the time it takes for a full impact of interest rate cuts to filter through into the economy ranges from 18 months to two years. Figure 1 illustrates the relationship between Mortgage Advance Growth and Interest Rates.

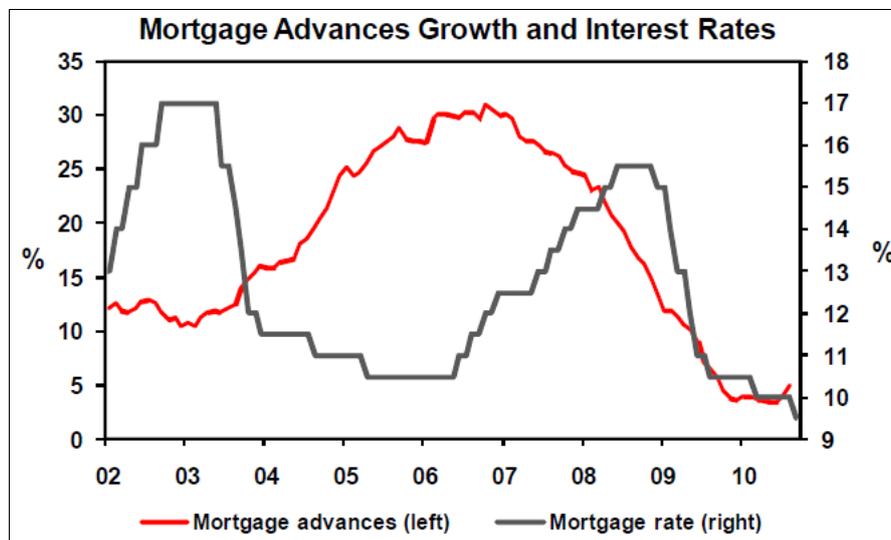


Figure 1 Mortgage Advances Growth and Interest Rates (Du Toit, 2010C)

The relationship between mortgage advances and interest rates is clearly a negative relationship. As interest rates increase, mortgage advances decrease and vice versa. It is clear that since the recent rate cuts this relationship has not been present. This indicates that there is another factor affecting mortgage advances.

According to Seeff (2010), the interest rate is not the factor that is holding the market back at present, it is the banks reluctance to lend. There is sufficient buyer interest, enough attendance at show houses and plenty of buyer viewing, but the offers to purchase which are not being approved are holding back the market at the moment.

4. RESEARCH

This paper presents part of the findings of research done on the effects of stringent lending criteria on the trends in the residential property market. The research is empirical data of a quantitative nature. There were two

types of data that were collected for this research, namely: primary and secondary data. The primary data used for the purpose of this study was empirical evidence, obtained using self-completion structured questionnaires, a quantitative method of obtaining data. The primary data was captured using electronic questionnaires which gathered information from the target populations. The data was analysed using statistical methods to produce descriptive statistics (Collis & Hussey, 2009). The primary data collected for this research was examined and compared to the secondary data which formed a theoretical basis for the research of the problem. The Secondary data was collected from existing literature sources and past records and statistics on the residential property market dating back to 2002.

Questionnaires were targeted at sample populations of estate agents at Estate Agencies and home loan consultants at Bond Originators in the Nelson Mandela Metropolitan area.

The following techniques were used to increase the response rates to the questionnaires:

- The respondents were assured of anonymity;
- Two reminder letters were e-mailed to non-respondents at different intervals, after the initial e-mails were sent;
- Each respondent was offered an executive summary of the research; and
- Phone calls were made to randomly selected people in the target populations, who had not yet responded, to politely enquire as to whether they were receiving the questionnaires and if they were planning on responding and/or if they required more time.

A total of 121 questionnaires were e-mailed to estate agents. 25 out of the 121 were returned four weeks after the questionnaires were first e-mailed to the participants, equating to a response rate of 21%, although one returned questionnaire was not satisfactorily completed and was excluded from the study.

A total of ten questionnaires were e-mailed to home loan consultants. Nine out of the ten were returned four weeks after the questionnaires were first e-mailed to the participants, equating to a response rate of 90%, although one returned questionnaire was not satisfactorily completed and was excluded from the study.

5. QUESTIONNAIRE DESIGN

The survey instruments used were two purpose designed questionnaires; one targeted at estate agents and the other at home loan consultants. Both questionnaires were formatted in an Excel® (Microsoft Ltd) workbook, and consisted of three sections.

The first section, in both questionnaires, asked questions relevant to the respondent's demographic data such as gender, age, title in company, experience and location.

The second section, in both questionnaires, had three sub-sections: The first sub-section consisted of questions on the general residential property market; the second sub-section consisted of questions

focused on FTB's in the residential property market; and the third subsection focused on BTL investors in the residential property market.

The third section, in both questionnaires, asked three open-ended questions. The three open questions requested respondents to comment or highlight important information pertaining to the effects of stringent lending criteria on: The residential property market in general; FTB's in the residential property market; and BTL investors in the residential property market.

7. FINDINGS

Table 1 Summary of key findings

<i>Change in activity levels expressed by estate agents:</i>	
Decrease in the residential property market activity level	53%
Decrease in FTB's activity level	65%
Decrease in BTL investor's activity level	68%
<i>Change in the amount of property buyers</i>	
Decrease in residential property market buyers	60%
Decrease in FTB's (actual activity level)	78%
<i>Stringent lending criteria are responsible for</i>	31%
Decrease in BTL investor (actual activity level)	80%
<i>Stringent lending criteria are responsible for</i>	33%
<i>Change in housing finance applicants (demand)</i>	
Decrease in total applications receive	41%
Decrease in FTB applicant's contribution	36%
Decrease in BTL investor applicant's contribution	34%
<i>Change in contribution of applicants to effective demand</i>	
Decrease in FTB applicant's contributing to effective demand	84%
<i>Stringent lending criteria are responsible for</i>	39%
Decrease in BTL investor applicant's contributing to effective demand	83%
<i>Stringent lending criteria are responsible for</i>	32%

The results of the study indicated that the perception of estate agents is that the current activity level in the residential property market has decreased by 53% since the implementation of the NCA. However, the decrease in FTB's and BTL investor's activity levels, 65% and 68% respectively, indicated that the perception is that there has been a larger decrease in the numbers of these two sub-groups than on others.

Furthermore, after calculating the amount of buyers over the increased time property is on the market it was discovered that the actual activity level of the residential property market has decreased by 60% since the implementation of the NCA. Whereas, the decrease in FTB's and BTL investor's, 78% and 80% respectively, is still significantly larger than the average decrease in the residential property market.

Furthermore, according to the perceptions of the estate agents, the implementation of the NCA, which caused stringent lending criteria, is responsible for 31% and 33% of the decrease in FTB's and BTL investors respectively. This indicated that stringent lending criteria are responsible for a 24% reduction in FTB's activity levels and a 26% reduction in BTL investor's activity levels.

The decrease in the amount of actual activity levels is however significantly higher than the decreases experienced in the amount of finance applications since the implementation of the NCA. The total decrease in finance applications was 41%. Furthermore, FTB contributions to the total amount of applications has decreased by 36% over this time, and BTL investor contributions to the total amount of applications has decreased by 34% since the implementation of the NCA. This result indicates that there has been a greater decrease in interest in the market from both FTB's and BTL investor sub-groups than the average decrease in interest in the market.

However, the decrease in effective demand contributions of FTB applicants and BTL investor applicants, 84% and 83% respectively, are significantly higher than the decrease in contributions of FTB and BTL investor applicants, and further more indicates why there has been a 78% and 80% decrease in FTB's and BTL investors.

Using the change in approval rates, it was concluded that the increased stringency of lending criteria was responsible for 39% and 38% of the decrease in FTB and BTL investor applicant's contribution to effective demand. This indicates that the stringent lending criteria are responsible for a 33% reduction in FTB applicant's contributing to effective demand and a 32% reduction in BTL investor applicant's contributing to effective demand. This information indicates the effects of the stringent lending criteria on the condition that all property buyers required finance from financial institutions and hence can be used as the upper limit of the effects of increased stringency in lending criteria.

8. CONCLUSION

The objective of this study was to investigate the relationship between stringent lending criteria and the trends within the residential property

market, in order to establish if the stringent lending criteria were partly responsible for suppressing activity in this market.

The research was structured to investigate the effects of stringent lending criteria on FTB's and BTL investors within the residential property market. This was done to establish if there is a reduction in FTB's and BTL investors, which in turn suppress residential property market activity.

It is clear that, since the implementation of the NCA, which caused stringent lending criteria, there have been substantial reductions in the proportions that the FTB's and BTL investors contributed to the demand for residential property. The proportion of the FTB's contribution has reduced by 45%, and the proportion of the BTL investor's contribution has reduced by 52%. The decrease in contribution is not unexpected considering the drastic decrease in activity of FTB's and BTL investors, 78% and 80% respectively.

The implementation of the NCA, which caused stringent lending criteria, was listed as the leading cause of the reduction of both, the FTB's and the BTL investors. The stringent lending criteria are causing a 24% reduction in FTB's, and a 26% reduction in BTL investors.

The vast reductions in the previously large contributions FTB's and BTL investors contributed to the total demand, indicates that they are two sub-groups of property buyers that have had a larger reduction in demand than other sub-groups of buyers in the residential property market, and that a reduction in these two sub-groups have enormous effects on the residential property market as a whole. Further, the percentage that the stringent lending criteria reduce FTB's and BTL investors is a clear indication that the stringent lending criteria in place at financial institutions, is a major factor in the reduction in demand for residential property. It can, therefore, be concluded that the stringent lending criteria to a large extent suppress activity in the residential property market.

9. RECOMMENDATIONS

Considering the results of this survey, a suggestion could be that estate agents should inform sellers that:

- They should only sell if it is imperative to do so;
- They should realise that the price they put their house on the market will more than likely not be the price they will achieve; and
- If their property it is not competitively priced, it could be on the market for a considerable length of time.

Government needs to take a serious look at excluding certain people from the terms of the NCA. For example, self employed individuals who have no credit defaults and a strong, long credit history.

The possibility for a potential buyer to waive their right to claim against a financial institution for reckless lending should also be considered, although suitable restrictions should be in place as to who could potentially waiver their rights.

Further research may include other sub-groups (only FTB's and BTL investors considered during research) within the residential property market as well as other markets, for example, the commercial, retail and industrial property markets.

There is also an opportunity for research to be conducted on the effects of the NCA, or stringent lending criteria, on development finance.

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Building construction and the rental sub-sector: effects on housing delivery system in Nigeria

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ABSTRACT

Purpose: With the increasing rate of urban growth and the low rate at which houses are being added to housing stock yearly, many renters are always finding it hard to survive. There is the problem of continuous exploitation by landlords because the renters have no choice. People who have no alternatives are exposed to the evil deeds of landlordism and this may leave tenants with very little after rent to take care of themselves. The degree of these shortages and their attendant socio-economic problems are what this paper has tried to examine.

Methodology: This study utilized both secondary and primary sources of data. The secondary data were collected from the Lagos State valuation office. There are 17 local governments divided into 8 areas and consisting of 57 zones in the metropolitan Lagos. The total number of properties in the 57 zones is 135,830 and a size of about 1% (1,410) was randomly selected. The statistical analyses used include analysis of variance, multiple regression model and factor analysis to explain the variations and relationships in house prices by location in various neighbourhoods.

Findings and Practical Implications: The figures of the submitted building plan and approved varied. Which indicates that rate of building construction is very low compared with expected demand from rentals. It was observed that the mean income is the best and most significant variable that affects the location and neighbourhood choices of renters. It affects the level of consumption of the other socio-economic variables. The results also shows that rental housing has a valid and productive role to play in national housing policy, a role which has significant consequence for the lower income segments of urban population in the developing world.

Keywords: Rental, Housing, Construction and Delivery system

1. INTRODUCTION

With the economic problem and current government policy on housing construction where it said that government in the first place had no business providing accommodation and transport for workers, all provisions

have been monetized, the era of using public funds to maintain houses for top civil servants was over (Aluko,2008). The expected problem is the shortage of houses that will affect the rental sub-sector. This is the focus of the research as it examines the socio-economic characteristics of the rental in housing delivery system.

Also, since the quality of properties in an area usually determines the type of people living in the area, the location confers some measure of value on the neighbourhood (Aluko, 2008). Furthermore, the economic and human ecological analysis of urban structures provides a number of elements that explains the location behaviour of households and groups (Aluko, 2007, 2008).

In a developing country like Nigeria, forces of industrialization, transportation improvement and urbanization bring in their wake a series of spatial problems especially in housing (Onibokun,2006). Since it is believed that in urban areas, there are employment opportunities and infrastructural facilities, people tend to agglomerate in the designated urban areas. And one of the consequences of the massive in-migration is the soaring rents for residential accommodation in the State capitals. There is also housing deficiency in qualitative and quantitative terms, and the loss of housing stock due to destruction and damages brought by natural disasters have continue to widen the gap between the demand and the supply of dwellings (Aluko,2008). The degree of these shortages and their attendant problems is reflected in the high room occupancy rates in many cities and the rapidly rising rent levels in recent years (Onibokun, 2006; Aluko, 2008).

Therefore, the set of rentals are the households that choose to rent primarily because the option of ownership is foreclosed by lack of capital or available land. Available results from the research carried out indicate that between one-third and two-thirds of the accommodations in typical cities are occupied under some form of rental tenure (Aluko, 2008). Since everybody can actually not build a house for himself due many factors which include large amount of money required to build a house, increasing cost of building materials, problems of acquisition of land and low income of many people, the only alternative is to find a place to rent. And it is obvious that large numbers of lower income people in the cities of the developing world live in rental housing, and the numbers daily continues to increase. In order to elaborate further on the socio-economic attributes of housing renters, we used the case study of metropolitan Lagos. The reason is based on the fact that Lagos is a type of city where all housing problems are present and can be better explained.

2. CONCEPTUAL LITERATURE

Even though there is a lack of consensus in existing literature as to the exact meaning or definition of housing (Salau, 1990), Marshall (1950) defined the term housing as a bundle of many different attributes purchased together. These attributes may contribute to the satisfaction of a variety of different wants, among which are shelter, convenience and social distinction. Bourne (1981) puts housing as all at once a physical entity, a social artifact, an economic good, a capital stock, status symbol, and at times, a political 'hot potato'. The World Health Organization (WHO) defines housing as "residential environment which includes, in addition to the physical structure that man uses for shelter, all necessary services, facilities, equipment and devices needed or desired for the physical and

mental health and social well-being of the family and individual" (Onibokun, 1990). The most important thing in the definitions is that the conception of housing must transcend its physical dimension. Rental on the other hand is defined as "a sum of money fixed to be paid as rent" (Onibokun, 2006). Rental housing can then be defined as the sum of money paid for living in a place.

From these definitions of rental housing, it will be adequate to examine the categories of rentals. Although they are difficult to distinguish, but each still has unique social and economic characteristics which is peculiar to different countries. The rental housing term only represents a diverse assortment of housing types and different tenure of arrangements. We shall examine the principal four categories of rental housing as identified by Andrew (1987), even though there are other various categories. They are: investor-owned commercial rental housing; owner-occupied commercial rentals; auxiliary units; and shared accommodation.

The investor-owned commercial rental housing is where full dwellings are developed, singly or in groups, and owned by a landlord who typically does not live in the dwellings. Landlords may be private businesses or public agencies operating in a commercial capacity. The second category of owner-occupied commercial rentals is the type where full dwellings are developed and managed in small groups, typically of two to four units, by an owner who occupies one of the units. Duplex apartments and subdivided older houses are frequent examples of this category.

The third type of auxiliary units is where dwellings are developed as additions or partitions of units initially intended to be single, and are managed by the owner-occupant of the original unit. The added units may be complete with all services, or may share access to common water and sewer, but at a level no worse than the owners. The shared accommodation means portions of a dwelling are leased to tenants, who must share both space and services with other tenants. The owner may be resident, sacrificing a degree of privacy in access to services and common areas, or may move out entirely. While the first two categories are likely to be developed and operated by the formal sector of the economy, the last two categories are generally supplied through the informal sector.

A lot of issues and other research works on rental housing have been well documented in Onibokun (2006), Aluko (2008, 2007).

3. IMPORTANCE OF RENTAL SUB-SECTOR TO HOUSING

The terms of rental differed substantially depending primarily on how much has to be paid in advance of occupancy. In some cases, the amount required may exceed the renter household's annual income and this is held by the landlord until the tenant leaves. And since it has been asserted that large numbers of low income people in the cities of the developing world live in rental housing (Onibokun, 2006), then the need to examine the benefits.

People choose rental tenure in order to have enough time for savings and provide enough capital to build their own houses in their chosen area. Although such households are seen as likely to be exploited by the rent they pay but sometimes their income and standard of living are better than owner-occupied rentals and the stage is seen as biding time

until they can make the transition to ownership. Rental housing also provide better standard of housing to greater numbers of households in the shorter term, at affordable levels of cost which is better than none or squatting under the bridges and uncompleted buildings.

The rental sub-sector is also very important because not everybody can own a house. The so called average people these days are tending towards the low income group. So households choose to rent simply because the option of ownership of a house is out of sight and the rental sub-sector is of great importance for these set of people.

The World Bank (2000) assisted projects shows that 30-50 percent of the residents of the area survey in developing countries are renters. But in Nigeria, it will still range between 60-70 percent for those urban dwellers who live in rental housing (Aluko, 2008). The situation may be different in rural areas where self- help building of houses may bring the figure to 20-40 percent of rentals. The Bank's 2000 policy statement on "shelter" asserted that rental facilities and typically shared accommodation are the principal way shelter needs are met for large numbers of people in many communities in the developing world whose incomes are among the lowest.

It is also important in that an active rental sub-sector may be particularly effective in delivery of improved living conditions to the lower income segments of the urban population and may increase total rates of private sector capital formation and investment in housing. The better understanding of rental housing markets and their role within the housing sector can also lead to more rational strategies for government intervention through production, regulation and or finance.

Even though the condition is different in developed countries like in the United States where the goal of home-ownership is a basic part of the culture. There has been serious questioning of the social benefits attributed to high rates of ownership, and concern about the pendulum of housing policy has swung too far in the direction of discouraging production of rental properties. All these could be attributed to the standard of living and per capital income of the people in the developed countries. No matter what is said of rental sub-sector, it is of great importance for benefits of improved affordability and cost recovery may be achieved for the housing sector as a whole.

4. STUDY AREA AND METHODOLOGY

The Lagos Metropolitan area located within Lagos State in the south western part of Nigeria serves the dual purpose of being a state and former national capital. It still serves as the country's commercial centre. It is situated on latitude 6° 27' North and longitude 3° 28' East along the West African coast. With an annual population growth rate of about 13.6 percent (about 5 times as fast as the national growth rate of 2.8 percent). Lagos is Africa's second fastest growing urban centre after Cairo, being a focal point for regional, national and international trade and served by significant and often overloaded road, rail, ocean and air transport facilities. The choice of the study area (Metropolitan Lagos) is based on many factors. The housing rental markets- submarkets are very well developed in Lagos. Consequently, it is possible to identify and analyse variations.

This study utilized both secondary and primary sources of data. The secondary data were collected from the Lagos State valuation office. There

are 17 local governments divided into 8 areas and consisting of 57 zones in the metropolitan Lagos. The total number of properties in the 57 zones is 135,830 and a size of about 1% (1,410) was randomly selected. Other secondary data consist of relevant information from journals, articles, research reports from government agencies and parastatals.

The main primary information was obtained from responses to questionnaires from residential buildings. We also have direct interviews and personal observations. This is essentially to complement the already available secondary data and other unavailable necessary information. The questions on the socio-economic variables include the age of the head of household, sex composition of heads, educational qualification, occupation of heads, size of households and average income of household monthly/per annum. There are other questions on the spatial location and neighbourhood of housing consumers as reflected in population densities. They include tenure, number of rooms per household, monthly rent, transport cost to place of work and types of infrastructural facilities provided. The statistical analyses used include analysis of variance, multiple regression model and factor analysis to explain the variations and relationships in house prices by location in various neighbourhoods.

5. RESULTS AND DISCUSSION

When we examine the housing delivery system, we tried to explain the total number of building constructions that is made available especially to the rental sub sector. Tables 5.1 to 5.7 give the statistics showing the number of certificate of occupancy received, processed, approved and collected between 2000 and 2006. When we compare the figures of the buildings that are finally ratified and collected with number of submissions for processing and approved, we found out that they are very low. Which indicates that rate of building construction is very low compared with expected demand from rentals. And the implications are high shortage and exploitation of rental masses. The minister for works and housing admitted when he said "the ministry is aware of the huge housing problems facing the people" (The Liberation, May 25, 2011, p.4). In the explanation of the socio-economic nature of the rentals, the following analyses were made. In the survey of the Lagos metropolitan area, a number of socio-economic variables were examined (see Table 5.8). They include households heads education, income, age, number of persons in households, length of stay, type of buildings, occupation, house tenure, place of work and reasons for living in the house. The following attempts were made to explain the variation in the socio-economic variables of the housing renters. The survey shows that 63.4 percent were tenants and 36.6 percent were owner-occupier, but our concentration is on the renters. The analysis shows that the mean age of household heads, the length of stay (in years) in the house and the area. The mean age was 51.1 years which indicates that the respondents were adults and in the working class. The length of stay shows the respondents have stayed in the house for a considerable number of years and could speak authoritatively on the situation in the area of domicile. Table 5.9 shows the mean yearly income of the renters, the number of persons within a household and the number of rooms occupied. Most studies observed that the higher the annual rent, the higher is the socio-economic class of the household. The analysis of the income variable

substantiates the importance of the income factor. It was observed that the mean income is the best and most significant variable that affects the location and neighbourhood choices of renters. It affects the level of consumption of the other socio-economic variables.

One of other important variables in identifying the social and economic status of a renter in different neighbourhoods is the rental value. The quality of properties, the basic amenities and their location confers some measure value on the renters. That is why some people, while considering their status socially and economically will always prefer specific neighbourhoods.

The renters were asked why they chose to live in their present houses, the reactions given vary over the neighbourhoods. 60.7 percent believed that it was because the houses were very close to their working places. 25 percent said the rent is affordable; 39 percent indicated that the environment is good and another 50 percent said that they have no choice. Since the variables are many and diverse, generally, income, house value, occupation, education, type of building, quality of properties, basic amenities provided and the neighbourhood will to a large extent determine the socio-economic status of a renter.

Neighbourhoods are naturally demarcated by the quality of facilities in general. It is the grouping of zones with the same and related housing attributes as analysed by the non-hierarchical technique that forms the identified housing sub-markets or socio-economic groups in Table 5.10. In the first cluster socio-economic groups, the areas comprised of high quality neighbourhoods and community environments. The buildings are usually well-maintained, neighbourhood facilities provided and in essence command

STATISTICS SHOWING THE NUMBER OF EFFICIENCY OF OCCUPANCY RECEIVED

Table 5.1 Monthly number of ECI's received, processed, approved and cancelled (2006)

Month	Received for processing			Approved			Cancelled		
	Total	Private	Public	Total	Private	Public	Total	Private	Public
Jan	10	12	44	96	12	12	12	12	12
Feb	22	47	56	157	252	15	15	15	15
Mar	219	11	18	182	175	11	11	11	11
Apr	13	11	11	152	175	11	11	11	11
May	222	13	18	152	111	11	11	11	11
Jun	18	17	17	185	117	11	11	11	11
Jul	192	17	17	150	188	11	11	11	11
Aug	157	16	16	150	150	11	11	11	11
Sep	11	11	11	152	151	11	11	11	11
Oct	18	17	18	152	151	11	11	11	11
Nov	15	15	15	152	151	11	11	11	11
Dec	11	11	11	152	151	11	11	11	11
Total	1000	111	111	1000	1000	111	111	111	111

Table 5.2 Annual Monthly approval of ECI's (Approved, processed, approved and cancelled) (2006)

Month	Received for processing			Approved			Cancelled		
	Total	Private	Public	Total	Private	Public	Total	Private	Public
Jan	10	12	44	96	12	12	12	12	12
Feb	22	47	56	157	252	15	15	15	15
Mar	219	11	18	182	175	11	11	11	11
Apr	13	11	11	152	175	11	11	11	11
May	222	13	18	152	111	11	11	11	11
Jun	18	17	17	185	117	11	11	11	11
Jul	192	17	17	150	188	11	11	11	11
Aug	157	16	16	150	150	11	11	11	11
Sep	11	11	11	152	151	11	11	11	11
Oct	18	17	18	152	151	11	11	11	11
Nov	15	15	15	152	151	11	11	11	11
Dec	11	11	11	152	151	11	11	11	11
Total	1000	111	111	1000	1000	111	111	111	111

Table 5.3 Annual Monthly Number of ECI's Received, Approved, processed and Cancelled (2006)

Month	Received for processing			Approved			Cancelled		
	Total	Private	Public	Total	Private	Public	Total	Private	Public
Jan	10	12	44	96	12	12	12	12	12
Feb	22	47	56	157	252	15	15	15	15
Mar	219	11	18	182	175	11	11	11	11
Apr	13	11	11	152	175	11	11	11	11
May	222	13	18	152	111	11	11	11	11
Jun	18	17	17	185	117	11	11	11	11
Jul	192	17	17	150	188	11	11	11	11
Aug	157	16	16	150	150	11	11	11	11
Sep	11	11	11	152	151	11	11	11	11
Oct	18	17	18	152	151	11	11	11	11
Nov	15	15	15	152	151	11	11	11	11
Dec	11	11	11	152	151	11	11	11	11
Total	1000	111	111	1000	1000	111	111	111	111

high value. The areas are of low density and well planned. This is evidenced by the average number of rooms in the sub-group, which is 4-6, and average number of persons in the household which is 6.1 in Table 5.2. The ratio is about 1:1.3 compared to ratio 1:2.1 in sub-group 2 and ratio 1:2.4 in sub-group 4.

The second and third housing socio-economic sub-groups consist of areas inhabited by upper and middle income households. The areas are relatively good with minimum density. The average number of rooms is 3 with average number of persons in the household as 6.2 (ratio 1:2.1). Most

values in the neighbourhood. For no matter how beautiful and well building designed a

Table 5.7: Monthly Analysis of Applications Received, Proceeded, Approved and Revenue Generated on Land Seizure, 2004

MONTH	NUMBER OF APPLICATIONS		REVENUE GENERATED
	RECEIVED	APPROVED	
Jan	144	75	91,067,871.00
Feb	175	119	81,427,724.00
Mar	172	104	102,022,617.00
Apr	129	74	109,825,183.00
May	159	112	101,474,111.00
Jun	146	114	130,311,009.00
Jul	175	114	115,277,717.00
Aug	172	114	102,022,617.00
Sep	172	114	102,022,617.00
Oct	172	114	102,022,617.00
Nov	172	114	102,022,617.00
Dec	172	114	102,022,617.00
Total	2378	1471	1,211,770,571.00

Source: Lagos State Lands and Survey Department, 2004

Table 5.8: Location of Land Seizures, as indicated by housing market

Location	Number of Applications	Revenue Generated
Alimosho	10	1,000,000.00
Agege	15	1,500,000.00
Badagry	20	2,000,000.00
Beke	25	2,500,000.00
Central Business District	30	3,000,000.00
Ikoyi	40	4,000,000.00
Victoria Island	50	5,000,000.00
Mushin	60	6,000,000.00
Ajegunle	70	7,000,000.00
Surulere	80	8,000,000.00
Shomolu	90	9,000,000.00
Ybeju	100	10,000,000.00
Other	110	11,000,000.00
Total	570	57,000,000.00

Table 5.9: Sub-market of housing market

Sub-market	Number of Applications	Revenue Generated
Sub-market 1	100	10,000,000.00
Sub-market 2	200	20,000,000.00
Sub-market 3	300	30,000,000.00
Sub-market 4	400	40,000,000.00
Sub-market 5	500	50,000,000.00
Sub-market 6	600	60,000,000.00
Sub-market 7	700	70,000,000.00
Sub-market 8	800	80,000,000.00
Sub-market 9	900	90,000,000.00
Sub-market 10	1000	100,000,000.00
Total	5000	500,000,000.00

could be in Mushin or Ajegunle, it will never command the same value as those in Ikoyi and Victoria Island.

In a highly disaggregated data, there are heterogeneous socio-economic groups. The above socio-economic groupings or Submarkets are further confirmed by Table 5.11 which shows the groups average values of the variables. Most of the mean values of the variables decreased from sub-group 1 to sub-group 4. While the yearly mean income in sub-group 1 is

#1,120,668.30 that of sub-group 2 is #160,000.00, sub-group 3 is #133,187.60 and sub-group 4 is #120,101.00. The mean house rents also decreased from sub-group 1 (#1,108,928.40) to sub-group 2 (#150,000.00),

Table 8.4: Rent for Various Groups of Rooms and units in 2008

Sub-group	Area	Area	Area	Area
1	1	1	1	1
2	2	2	2	2
3	3	3	3	3
4	4	4	4	4
5	5	5	5	5
6	6	6	6	6
7	7	7	7	7
8	8	8	8	8
9	9	9	9	9
10	10	10	10	10
11	11	11	11	11
12	12	12	12	12
13	13	13	13	13
14	14	14	14	14
15	15	15	15	15
16	16	16	16	16
17	17	17	17	17
18	18	18	18	18
19	19	19	19	19
20	20	20	20	20
21	21	21	21	21
22	22	22	22	22
23	23	23	23	23
24	24	24	24	24
25	25	25	25	25
26	26	26	26	26
27	27	27	27	27
28	28	28	28	28
29	29	29	29	29
30	30	30	30	30
31	31	31	31	31
32	32	32	32	32
33	33	33	33	33
34	34	34	34	34
35	35	35	35	35
36	36	36	36	36
37	37	37	37	37
38	38	38	38	38
39	39	39	39	39
40	40	40	40	40
41	41	41	41	41
42	42	42	42	42
43	43	43	43	43
44	44	44	44	44
45	45	45	45	45
46	46	46	46	46
47	47	47	47	47
48	48	48	48	48
49	49	49	49	49
50	50	50	50	50
51	51	51	51	51
52	52	52	52	52
53	53	53	53	53
54	54	54	54	54
55	55	55	55	55
56	56	56	56	56
57	57	57	57	57
58	58	58	58	58
59	59	59	59	59
60	60	60	60	60
61	61	61	61	61
62	62	62	62	62
63	63	63	63	63
64	64	64	64	64
65	65	65	65	65
66	66	66	66	66
67	67	67	67	67
68	68	68	68	68
69	69	69	69	69
70	70	70	70	70
71	71	71	71	71
72	72	72	72	72
73	73	73	73	73
74	74	74	74	74
75	75	75	75	75
76	76	76	76	76
77	77	77	77	77
78	78	78	78	78
79	79	79	79	79
80	80	80	80	80
81	81	81	81	81
82	82	82	82	82
83	83	83	83	83
84	84	84	84	84
85	85	85	85	85
86	86	86	86	86
87	87	87	87	87
88	88	88	88	88
89	89	89	89	89
90	90	90	90	90
91	91	91	91	91
92	92	92	92	92
93	93	93	93	93
94	94	94	94	94
95	95	95	95	95
96	96	96	96	96
97	97	97	97	97
98	98	98	98	98
99	99	99	99	99
100	100	100	100	100

Table 8.11: Analysis of Housing Variables for Lagos Metropolitan Area (Lagos State)

Variable	Sub-group 1	Sub-group 2	Sub-group 3	Sub-group 4	Overall Mean
NO. OF ROOMS	120668.30	160000.00	133187.60	120101.00	117216.5
RENT	108928.40	150000.00	133187.60	120101.00	107363.5
AREA	6.6	4.5	3.0	2.8	3.5
AREA	1478.4	1780.0	1018.0	499.6	963.9
AREA	44.9	32.4	17.0	17.0	27.1
AREA	5.8	0.1	6.3	6.1	4.6
AREA	15.1	10.0	16.6	14.7	16.7
AREA	10.5	18.4	10.5	10.1	15.7
AREA	121.0	600.0	1000.0	1000.0	1113.4
AREA	0.7	0.2	0.8	0.6	0.7
AREA	0.6	0.7	1.1	0.8	0.7
AREA	1.2	2.1	2.0	1.5	2.1
AREA	1.0	1.4	1.3	0.8	1.3
AREA	1.7	1.6	0.8	1.3	0.8
AREA	0.9	0.8	0.8	0.8	0.7
AREA	0.9	0.8	1.1	0.6	0.7

sub-group 3 (#117,829) and then sub-group 4 (#110,132.30). The number of rooms occupied by each household (NROOM) followed the same trend.

6. CONCLUSION

From the above analysis of rental sub-sector, it can be seen that whether by necessity or choice, large numbers of households will continue to demand rental housing in the developing world's cities. It is also necessary that greater numbers of people particularly those in the lower income categories could be helped more rapidly and more effectively through programmes which take a balanced approach toward developing housing for rental as well as for ownership. Such programmes could increase total housing supply at more affordable standards, increase rates of capital formation and private sector participation by mobilizing additional resources in the housing sector, and improve the likelihood of cost recovery and replicability.

The government through its agencies should exert more positive efforts to assure not only that this important sub-market is not appropriately suppressed by national policies and local practices which discourage production of rental housing, but further, that Federal Housing Corporations and other financial institutions should sponsor urban housing projects which will offer balanced opportunities to developers of rental as well as owner-occupied housing.

Finally, rental housing has a valid and productive role to play in national housing policy, a role which has significant consequence for the lower income segments of urban population in the developing world.

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An Analysis Of The Relationship Between Infrastructural Facilities And Residential Property Values In Satellite Towns Of Abuja, Nigeria

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ABSTRACT

Purpose: This research work aims at analyzing the relationship between infrastructural facilities and residential property values in Abuja, Nigeria

Design/methodology/approach: The study with Mpape and FHA (satellite towns), Abuja as study areas employed the use of structured questionnaires; data collected were analysed using regression analysis with the aid of SPSS.

Findings: It was revealed that in Mpape infrastructural facilities are not significant predictor variables in the determination of residential property values, contrarily in FHA Lugbe infrastructural facilities are significant predictor variables in the determination of residential property values in FHA Lugbe

Originality/value: The study has been able to reveal that in Abuja the federal capital of Nigeria, areas with inadequate infrastructural facilities can still command high rent as the case with Mpape. On the other hand, provision of adequate and standard facilities remains strong determinants of property value as in the case with FHA, Lugbe. Property developers should be guided by these facts.

Key Words: Residential property, infrastructural facilities, property values.

1.0 INTRODUCTION

Infrastructure are the stationary physical man-made elements in our environment such as public utility equipment, telecommunication network, power, transportation and power distribution network; water works installations and distribution network. It includes buildings, recreational facilities and all man-made features of our landscape. Infrastructure has the capabilities to facilitate agricultural, industrial and a social development in a country. Infrastructure refers to the aggregate of all facilities that allows a city function effectively (Nubi, 2002).

Okusipe(1999) pointed out that infrastructure is a critical agent for socio-economic development of any urban area. It plays an indispensable role in the economic, social and environmental aspect of life of an urban setting. Hence, it is considered as the backbone of any economy as it covers a wide range of services and facilities namely electricity, water supply, access road, waste disposal, drainage, communication, primary health services amongst others. Property on the other hand, means anything that can be possessed or something over which ownership rights can be exercised (Olayonwa, 2002). In other words, property transcends ordinary shelter and comprise of the facilities as well as other aspects of the social environment which links man with his immediate environment, it includes the building structure, open space as well as facilities such as drainage, water supply, road networks, hospitals and just to mention a few. Property values are a function of various factors. The value of a property is credited and thus varies as a result of the changing factors in its relationship with other inherent attributes in a particular area.

In Nigeria today, government at all levels have been responsible for setting up Infrastructure through her agencies such as Power Holding Company of Nigeria (PHCN), Federal Ministry of Works and Housing, Waste Management Board, Federal Housing Authority, just to mention a few, for the purpose of providing support to the environment and the enrichment of her citizenry with benefits from such provision. In Abuja, Nigeria Federal capital due to the ever growing population and demand on housing, satellite towns have been created. Satellite towns are new towns planned and built to serve a particular local industry, or as a dormitory or overspill town for people who work in a nearby metropolis The creation of these satellite towns necessitated the development of Infrastructure to improve the environment and attract property investors. Oduwaye (2004) reported that "access to good roads, drainages, electricity, and availability of standard facilities and amenities will increase property values at any particular time. Studies have been carried out on the effect of infrastructural facilities on rental value (Olujimi and Bello, 2009).

2.0 PROBLEM STATEMENT

One major problem faced by satellite towns in Abuja is inadequate availability of infrastructural facilities. Relatedly, residential properties cannot be conveniently habitable without referencing to infrastructural facilities. There is a general agreement that an increase and improvement in infrastructural facilities will lead to an increase in property values thereby establishing a relationship. What is not clear is the nature and strength of such relationship. Thus, it is therefore necessary to establish the

relationship between infrastructural development and residential property values. Is there relationship between infrastructural facilities and property value in satellite towns? What is the strength of such relationship? These are the pertinent questions this work tends to address

3.0 THEORETICAL FRAMEWORK

3.1 Determinants of Property Value

Residential property has no value if it has no utility, not scarce and effectively demanded. Residential property has significance only as it satisfies man's needs and desires. It is this collective desire that gives its value (Kuye, 2003). Thus, the ability of a property object to satisfy man's needs and desires together with its degree of scarcity and utility compared with others makes man to ascribe value to it. Property value, therefore, according to Millington (1981) is the money obtainable from a person(s) willing and able to purchase property when it is offered for sale by a willing seller, allowing for reasonable time for negotiation and with full knowledge of the nature and uses which the property is capable of being put.

Certain factors determine values of individual properties and also affect property values collectively. Briton et al (1988) identified location, state of repair, accommodation details, services, proper interest and time as individual property value determinants. They further stated that the factors that dictate the prevailing level of collective property values in a neighborhood at a particular point in time range from physical topography, configuration and features of the surroundings, social-political factors; infrastructural facilities and services, government presence, class or status of occupation, economic to legal factors; collectively they all affect property values than in isolation either to cause "appreciation or depreciation" of property values.

3.2 Infrastructural Facility Availability as a Determinant of Property Values

Briton et al (1988) opined that infrastructural facilities are determinants of property values; its presence leads to appreciation of property value. Unfortunately, the level of availability of infrastructure in our country is drastically low which calls for concern particularly on the part of the government at all levels. Mabogunje (1993) decries the unavailability of services such as water and sanitation, which he suggested are a measure of welfare. Thus, he concluded that people are poor because they do not have access to basic necessary services. A residential user may be prepared to pay high value for a property depending on his consideration for basic facilities such as accessibility, water and electricity (Harvey, 1999). Accessibility which is a direct consequence of good road network, in turn

leads to high rental values of location with greater accessibility advantages (Aibangbee, 1997).

In a situation where properties are accessible via motor able road networks, such properties will enjoy high rental values as Hammer et al (2000) pointed out that provision of good and adequate infrastructure is central to property values. Evidently, provision of wholesome and portable infrastructure is of necessity to every household; Keeble (1969) recognized this when he said water is indispensable to household as it is necessary for drinking, cooking, bathing, and doing other domestic activities.

In retrospect, properties in areas that are well serviced with pipe-borne water tend to experience higher rental values compared to areas where service is non-existent. Litchfield (1974) also observed that areas with basic facilities such as access roads, good drainage, electricity, public water supply and telecommunication would attract high property values. This is contrary to areas without any of these facilities where the absence of such infrastructural facilities affects neighborhood properties adversely (Briton et al, 1989).

4.0 RESEARCH METHODOLOGY

The nature of study being addressed in this paper suggests an empirical study involving a field survey to collect primary data from the population made up of residents of Mpape and FHA Lugbe. The research methodology was designed to obtain data on the analysis of the relationship between infrastructural facilities and residential property values in Mpape and FHA Lugbe from 2001-2010. As a necessary prelude, a reconnaissance survey purposely designed to familiarize the researcher with the available types of residential property and Infrastructure in the study areas.

Data were collected on the distribution of residential property, the types and the conditions of infrastructural facilities provided and rents paid by tenants among others. The second set of questionnaire was designed for the practicing Estate Surveyors and Valuers in Abuja. A total of 450 questionnaires were randomly distributed to the tenants of Mpape and FHA Lugbe using the simple random sampling technique; 250 questionnaires were administered to Mpape while 200 questionnaires to FHA Lugbe; representing 10% of the total population in both areas. Also, 10 questionnaires were randomly distributed to Estate Surveyors and Valuers.

The analysis of the data collected from the tenants was done using multiple regression model to determine the interrelationships between each of the isolated Infrastructure (i.e., water, electricity, and road) which are the independent variables; and the rental value of the residential property (dependent variable). This model not only handled the problem of interactions amongst the independent variables but also it enabled the researcher to know the contributions or the importance of each variable to the explanation of variation in the dependent variable (rental value). It also allows for the prediction of value of the dependent variable. According to Bryman *et al.* (1990), the equation of multiple regression y (dependent variable) on $X_1, X_2, X_3, X_4, \dots, X_n$ (independent variables) is given as: $Y = a + b_1X_1 + b_2X_2 + b_3X_3 + \dots + b_nX_n + e$

Where: x_1, x_2, \dots, x_n = the independent variables

b_1, b_2, \dots, b_n = Multiple regression coefficients for the independent variables (the slope of the regression line relative to x-axis)

a = the intercept

Y = Dependent variable

However, the application of this model to this research work shows that:

$$Y = a + b_1 \text{ELEC} + b_2 \text{WAT} + b_3 \text{ACESROAD}$$

Where:

Y = the annual rental value

ELEC = Electricity

WAT = Water

ACESROAD = Access road

5.0 THE CASE STUDY

5.1 Mpape

One of the study areas for this research work is Mpape, a Gbaygi word meaning "we are crossing the river ahead of war to victory rock". The name was given as after the slavery war many years ago. The ruling system of Mpape is by inheritance. Mpape, a town surrounded by rocks, is a satellite settlement in Abuja, located at the eastern part of the capital city. Mpape is one of the most populated satellite towns in Abuja in recent times due to its proximity to the capital city. It's proximity to the capital city has attracted many residents of the FCT whose houses were affected by the demolition exercises embarked upon by the former FCT administration. The study area reveals a state of very poor sanitation, over-crowding, poor maintenance of building, public facilities and amenities with congested houses. The area is highly populated and lacking in basic Infrastructure like good motor able road, portable water, drainage and near total absence of electrical supply to the area. Majority of the buildings are dilapidated, characterized by cracked walls and floors, rusty roofs, and unplanned preventive and routine maintenance. Majority of the houses are tenement buildings, sharing common facilities like toilets, bathrooms and kitchen. Most of the buildings are constructed with mud brick (plastered); windows are majorly of wood, metal and glass etc. the doors are flush plywood, metal. The roofing materials mostly are of corrugated iron sheets. The area is regarded as a "ghetto" or "a slum".

5.2 FHA Lugbe

The Federal Housing Authority established under decree No.40 of 1973 commenced the Lugbe project in 1994 under National Housing Programme for the provision of mass housing for the low income citizens. The house types consist of 1-Bedroom bungalow, 2Bedroom bungalows and 3-Bedroom detached bungalows. The estate was built by the government and on completion is sold to individuals who can afford to buy. The estate is duly provided with basic infrastructure such as electricity, road network, and

refuse disposal amongst others. The housing types vary but they all have similar characteristics in their design patterns.

6.0 RESULTS AND DISCUSSION

6.1 Analysis of the Relationship Between Infrastructural Facilities And Rental Values In Fha Lugbe And Mpape.

Hypothesis

Null Hypothesis [H_0]: There is no significant relationship between infrastructural facilities and residential property values in Mpape

With significance level of 0.05 signifying 95% level of confidence, the empirical results presented in table 6.1 reveals that electricity, access road and water supply have probability values of 0.065, 0.067 and 0.310 respectively which is greater than the significance level.

1. Regression results between annual rent and infrastructural facility variables in Mpape.

Code	Variable	Regression coefficient	Beta coefficient	Absolute t-value	Sig.
(Constant)		3.167		3.630	0.000
ACESRD	Road	1.130	0.227	1.850	0.067
ELEC	Electricity	-0.468	-0.181	-1.861	0.065
WAT	Water supply	0.271	0.134	1.019	0.310
R=0.336					
R ² =0.113					
R ² adjusted=0.089					
N=116					

SOURCE: AUTHORS FIELD SURVEY, 2010

Decision: where infrastructural facilities (electricity, water supply and access road) are not significant predictor variables in the determination of residential property values in Mpape; therefore the null hypothesis $\{H_0\}$ is accepted.

This shows no statistical significance; in the consideration of the entire variables fitted into the model, R² (0.113) shows 11.3% of the variation in rental value are jointly accounted for by the variables.

Thus:

$$Y = a + b_1 \text{ACESROAD} + b_2 \text{WAT} + b_3 \text{ELEC}$$

$$\text{Rentalvalue} = 3.167 + 1.130 \text{ACESROAD} + 0.271 \text{WAT} - 0.468 \text{ELECT}$$

The standardized beta coefficient shows the contribution that an individual variable makes to the model. The beta weight is the average amount the dependent variable increases when the independent variable increases by one standard deviation (all other independent variables are held constant); while t-value tests the two-tailed hypothesis that the beta value is significantly higher or lower than zero. The largest influence on rental value is from access road (0.227) with t- value of (1.850) and the next is water supply (0.134) with t-value of (1.019) followed by electricity (-0.181) with t-value of (-1.861); all these predictor variables (electricity, water supply and access road) are insignificant predictors to the rental value of residential properties in Mpape. It can be deduced further that there are other motivating factors such as nearest to the city encouraging demand for accommodation in the area apart from infrastructural provision.

2. Regression results between annual rent and infrastructural facility variables in FHA Lugbe

SOURCE: AUTHORS FIELD SURVEY, 2010

Code	Variable	Regression coefficient	Beta coefficient	Absolute t-value	Sig.
(Constant)		21.889		6.352	0.000
ELECT	Electricity	-6.768	-0.574	-8.512	0.001
WAT	Water supply	0.984	0.299	4.186	0.001
ROAD	Road	2.281	0.119	1.792	0.076
	R=0.776				
	R ² =0.602				
	R ² adjusted=0.591				
	N=106				

Hypothesis

Null Hypothesis [H₀]: There is no significant relationship between infrastructural facilities and residential property values in FHA Lugbe with significance level of 0.05 signifying 95% level of confidence, the empirical results presented in table 7 reveals that electricity and water supply with probability values of 0.001 correspondingly are significant predictor variables to the with significance level of 0.05 signifying 95% level of confidence, the empirical results presented in table 7 reveals that electricity and water supply with probability values of 0.001 correspondingly are significant predictor variables to the rental value of residential properties in FHA Lugbe while access road with probability value of 0.076 which is greater than the significance level shows no statistical significance; in the consideration of the entire variables fitted into the model, R² (0.602) shows that 60.2% of the variation in rental value are jointly accounted for by the variables.

Thus:

$$Y = a + b_1 \text{ACESROAD} + b_2 \text{WAT} + b_3 \text{ELEC}$$

$$\text{Rental value} = 21.889 + 2.281 \text{ACESROAD} + 0.984 \text{WAT} - 6.768 \text{ELEC}$$

Decision: where infrastructural facilities (electricity and water supply) are significant predictor variables in the determination of residential property values in FHA Lugbe; therefore $\{H_0\}$ is rejected.

The Beta coefficient shows the contribution that an individual variable makes to the model. The Beta weight is the average amount the dependent variable increases when the independent variable increases by one standard deviation (all other independent variables are held constant); the largest influence on the rental value is from water supply (0.299) followed by access road (0.119) and then electricity (-0.574); it should be noted that though access road influences rental value is not a significant predictor to the rental value of residential properties in FHA Lugbe. This is not far from the truth that access road generally in the country is poor and devastating; therefore, it does not significantly predict the rental value in this area though its availability influences the rental values.

6.4 Willingness to Pay Higher Rent for Better Infrastructure.

A survey was carried out in the neighbourhoods of Mpape and FHA Lugbe on the willingness by the tenants to pay an increased rent in the residential property they occupy whereby there will better provision of infrastructure with adequate maintenance.

The result of this survey on this question shows that 68% responses in Mpape are ready to pay higher rent in case of improved infrastructural facilities; in order of preference, good road with 78.4% next to electricity with 71.6%, and followed by potable water with 61.2% responses; while 52.5% in FHA Lugbe, affirmed their willingness to pay higher rent for electricity, thus signifying a need for total improvement in infrastructural facilities in both areas but more significantly in Mpape.

7.0 CONCLUSION

The result of the analysis employed in this study has provided a detailed insight as regards the relationship between infrastructural facilities and residential property values in the study areas. The provision of adequate and standard facilities remains strong determinants of property value. Property investors and developers should be guided by the fact that presence of adequate infrastructural facilities is always a boost to property value. Hence, in property development decision, infrastructural facilities availability remains a strong factor.

8.0 RECOMMENDATION

With respect to the findings discussed, there is need for property developers in satellite towns in Abuja and Nigeria as a whole to consider the important role of infrastructural facilities in value determination. Due to the ever growing population in Nigeria, Satellite towns are being created; government and other players in housing provision should have a framework that supports infrastructural development and maintenance. This is necessary in achieving the objectives of creating satellite towns

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An assessment of the needs of women-owned construction enterprises in south africa for construction empowerment, development and sustainability (CODES)

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ABSTRACT

Purpose of this paper: This paper reports on the findings of a needs assessment study of South African (SA) Women-Owned Enterprises in construction. The study was done in preparation for the rolling out of an empowerment initiative in South Africa. The study builds on the lessons learnt and recommendations from the 'Women-helping-Women' study.

Design/methodology/approach: Relevant literature was reviewed. A survey instrument was developed and professionally facilitated workshops, supervised by stakeholders, informed the needs assessment.

Findings: Fair procurement, women friendly construction sites, a construction bank and relevant career-aligned training with mentoring will enable the respondents to transform their enterprises to be sustainable multi-skilled independent entities that are able to construct the infrastructure needed.

Research limitations: Findings are based on views from respondents in SA registered with the Construction Industry development Board (CIDB) and also with legitimate e-mail addresses.

Practical implications: Given the professionally facilitated workshops and stakeholder involvement in the instrument developed from start to finish the findings of the study proved to be reliable and valid and could be used for similar interventions.

Value of paper: Knowledge sharing for auctioning by government, the building industry, development finance institutions and women associations on the critical skills shortage, gender equity and empowerment added value.

Keywords: Women-Owned Enterprises, Construction, Needs assessment, Sustainable Development, Growth and Success

1. INTRODUCTION

The Development Bank of Southern Africa (DBSA) and the South African Federation for Civil Engineering Contractors (SAFCEC), engaged in a capacity building exercise on a civil project, where 20 women entrepreneurs were mentored. Following on the success of and lessons learnt from this particular pilot project, women-helping-women (Verwey 2008), one of the recommendations was to roll out this intervention to all provinces, including other disciplines in the construction sector that had not been covered in the pilot intervention. Moreover, in a Women Leadership Convention sponsored by the DBSA along with other stakeholders, held at Polokwane in February 2008, one of the main resolutions adopted acknowledged that although inroads have been made with women's empowerment over the years, the glass ceiling still exists for women entrepreneurs, limiting their enterprise growth and upward progression through the Construction Industry Development Board (CIDB) grading levels for meaningful participation in the construction industry. The resolution captured the commitment from stakeholders at the convention to come up with appropriate industry aligned interventions to pin-point and address the gaps and shortcomings that exist. This particular study was undertaken by the Development Bank of Southern Africa with South African Built Environment Research Center (SABERC), Mississippi State University (MSU) and the University of Johannesburg (UJ) to determine the exact needs to inform appropriate interventions.

2. PURPOSE OF THE PAPER

The purpose of the paper is to share the findings from a multi-stakeholder needs assessment for the development of a women's empowerment model, to address the critical skills shortage and gender imbalance in the SA Construction Industry (SACI). It also serves as an exploratory study for further studies to address the gaps that have been found in previous studies.

3. PROBLEM STATEMENT

Understanding the environment that a women-owned construction enterprise in SA operates in will provide insight into the problems they experience.

South Africa is a country of contrasts. The 'developed sector' of the economy is on a par with developed economies anywhere, on almost any criteria – excellent health facilities, world-class education, high-end housing

and sophisticated commercial buildings. However, the 'developing sector' encompasses all the challenges of developing economies worldwide – widespread unemployment and poverty, lack of skills and education, low levels of health care and lack of housing (Global Reporting 2010).

According to CIDB (2010 a) infrastructure investment has the following multiplier impact:

- Buildings: 4,2 formal jobs are created for every R1 million invested in building
- Construction: 2,3 jobs for every R1 million invested in construction
- Building and construction: 3,4 formal jobs per R1 million invested in building and construction.
- Informal sector: In addition around 2,4 jobs are created in the informal sector per R1 million invested in building construction from "labour only" to "labour and materials" subcontractors.
- The total job creation multiplier: 5,9 jobs per R1 million invested.

Mainstreaming of women in the economy is a key goal for DBSA, derived from the Millennium Goals adopted by the SA Government and as captured in the Accelerated Shared Growth Initiative of South Africa (AsgiSA) and Joint Initiative on Priority Skills Acquisition (JIPSA) programmes. The problem is a lack of suitably skilled women entrepreneurs to participate in infrastructure delivery projects and programmes.

A comparison is made between the CIDB register at December 2008 and the current situation (March 2011). Table 1 reflects slow progress with transformation in the construction industry, indicating that limited numbers of women-owned construction enterprises were registered in the upper categories of the Construction industry development board (cidb) contractor register. In the absence of a model of capacity building and integrated training programmes aligned to industry needs gender inequality still exists in the construction industry with the exception of Grade 8 where a modest climb from 6% to 15% is recorded. Fewer contracts and sub-contracts from the public sector where there are at least policies and incentives to open opportunities for women entrepreneurs in construction just means that women are most hard hit in times of a stressed economy. They need those projects where training and growth of women enterprises are built in and monitored.

Considering the decline evident from the start of the 'Women-helping-Women' pilot project to the completion of the needs assessment study, there clearly is a need to bridge the skills gap and to accelerate the upward progression of women-owned construction industry enterprises through the grades with appropriate interventions such as a needs assessment to pin-point and address the shortcomings and constraints through capacity building interventions such as enterprise development, mentoring and coaching.

Table 1. Women Owned by Grading – all Provinces (CIDB 19 December 2008 – March 2011)

Designation	Max value of contractor capability	Total number of construction businesses	Women Owned	Women % of Grade	Black-owned % of Total
Year	2008/2011 In Thousands of Rands	2008/2011	2008/2011	2008/2011	2008/2011
1	R200/R200	62139/79004	30658/38604	49/49	97/97
2	R500/R650	5142/4344	2365/2146	46/49	90/93
3	R1,500/R2,000	1486/1440	701/686	47/48	88/86
4	R3,000/R4,000	1906/2179	775/939	41/43	82/79
5	R5,000/R6,5000	1134/1926	411/654	36/34	75/70
6	R10,000/R13,000	926/1437	278/476	30/33	72/69
7	R30,000/R40,000	447/562	95/144	21/26	53/51
8	R100,000/R130,000	120/204	7/30	6/15	28/34
9	Unlimited	123/128	1/1	1/1	3/9
Total		73423/91224	35291/43680	48/48	95/79

4. Research Questions

The research questions that this paper is dealing with are summarised as follows

- Is the under representation of women-owned enterprises in SA in the higher grades of the CIDB due to a lack of an integrated career-focused training programme that is aligned to the needs of women entrepreneurs at various levels of their development?
- What are the other constraints limiting women-owned enterprises to the lower grades of the construction industry development board, inhibiting the sustainability and growth of their enterprises?

5. Methodology

Several strategies were followed that included a literature survey, a needs assessment survey instrument that was designed and followed through using the database of the construction industry development board (cidb) and in addition needs assessment workshops were conducted. These workshops were used to

- establish the potential outcomes of developing women-owned construction enterprises;
- identify the perceived barriers and constraints to this development;

- and
- determine the potential for development.

A total number of 139 women-owned construction enterprises participated in the workshops in six centers, namely Durban, East London, Johannesburg, Mafikeng, Kimberley and Bloemfontein.

6. Limitations and Demarcation of the study

Only women-owned enterprises registered on the cidb register and with legitimate e-mail addresses were used in the study. It is assumed that the turnover per level reflects the inherent capabilities required to handle projects of that scope and nature. It is acknowledged that not all women-owned enterprises necessarily wish to proceed to higher grades as it is possible to have growth of different dimensions within a level and that is purely linked to personal aspirations and goals.

7. Defining growth and success as a construct in enterprise development

For the women-owned enterprises to successfully grow towards sustainability programmes and interventions should be based on elements contained in the Four-Growth-Perspectives model that illustrates the growth in enterprise development as follows:

Financial growth relates to the development of the business as a commercial entity. It is concerned with increases in *turnover*, the *costs* and *investment* needed to achieve turnover, and the resulting *profits*, as well as increases in what the business owns: its *assets* (Wickham 2001).

Strategic growth takes centre stage. It relates to the changes that take place in the way in which the organisation interacts with its environment as a coherent, *strategic*, whole (Wickham 2001).

Structural growth relates to the *changes* in the way the business organises its internal systems, managerial roles, responsibilities, reporting relationships, communication links and resource control systems (Wickham 2001).

Organisational growth relates to the changes in the organisation's *processes, culture and attitude* as it grows and develops (Wickham 2001).

It is important to note that the *four types of growth* described are not independent of one another. They are merely different facets of the same underlying process. (Wickham 2001:304).

According to Probst & Raisch (2005) success can be measured in terms of four key factors: a high growth rate, the ability of change continuously; a highly visionary company leadership and a success-oriented company culture. They caution companies that in order to sustain success they need to keep a balance as there is a fine line between success and failure. The great majority of companies that failed possessed these factors in abundance. In fact that is exactly where they failed

7. Findings of the study

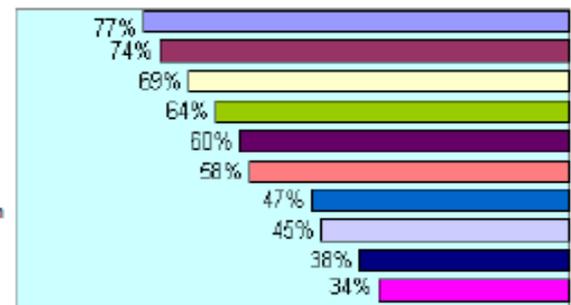
Only the most pertinent findings are reported here relating to the research questions stated up front and those are:

The question raised in the workshops was: In an ideal world what would a woman construction entrepreneur see as important issues to pursue? Why are they in construction?

Responses pointed to social responsibility and job creation that was frequently raised for a more secure and enabling environment and being able to influence government policy with regard to the way women contractors procure work from government institutions (Fester, Haupt & Mohammed 2010). Other reasons why women are in construction are reflected below:

Why do women get involved in construction?:

New challenges
 Need for achievement
 Love for construction and building
 Preference for independence
 Financial security, to earn a living
 Need for recognition and ambition
 Unemployment, unable to obtain a salaried position
 Followed role models
 Little job satisfaction at previous workplace
 Motivated by family members



Those who Strongly agreed, on four point Likert scale, N=3

Figure 1: Why women entrepreneurs are pursuing careers in construction (Verwey 2003)

Further responses were:

Barriers and other constraints to development:

Perceived corruption within government departments on issuing of contracts were cited as a major constraint. The fact was noted that a lack of "contacts" within the government sector made it unlikely to be awarded projects. The lack of a sustainable work flow / continuity of work and the stop/go effect that negatively impact on staff retention were raised as issues of concern (Fester, Haupt & Mohammed 2010).

Other barriers for women in construction are reflected in the graph below indicating obstacles women in construction face along their careers, lacking support and dedicated flexible educational, training and mentoring programmes suited to women in their dual roles of being mothers and career women. Specific interventions and strategies are required to remove the obstacles to enhance their development towards sustainable construction enterprises.

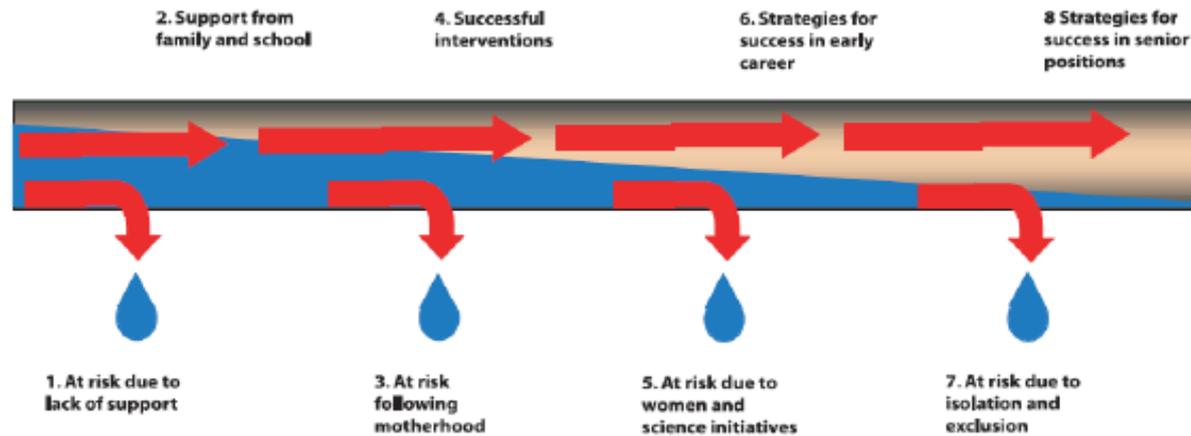


Figure 2: The leaky pipeline of barriers for women in construction (CEWS 2006)

The questions that are asked are, what can be done to achieve set goals?

The respondents felt that seeing construction as a career and not only a commercial opportunity would garner greater respect for women-owned enterprises than those who entered the industry for short term gains (Fester, Haupt & Mohammed 2010). Mentoring and coaching are ways to achieve growth and success. That points to answering the first research question:

One of the main reasons for the under representation of women-owned enterprises in South Africa in the higher grades of the cidb is a lack of an integrated career-focused training programme aligned to the needs of women entrepreneurs at various levels of their development. Goal setting in terms of their vision for their enterprises and careers were likewise viewed as important. In addition the appointment of a Construction Ombudsman was seen as important for an enabling environment for construction entrepreneurs.

Findings of the study (Haupt & Fester 2010)

Under employment it was found that the mean number of males employed = 9.15

The mean number of females employed = 2.90

In response to the questionnaire the following information was obtained to profile the respondents

The following was reported:

- Operating from home 70%
- Own a computer but do not necessarily use it (need basic training course) are 81.3%

- Have post matric education in the form a college/technical college 73.6%
 - Have formal construction or building qualifications 17.6%
 - Understood the cidb grading system 6. 85%
 - Cidb Registered 100%
 - Registered in category 1 are 65% with the highest grading being category 5 at 10% of respondents
 - Were unaware of any supporting organizations 70.0%
 - Of those who were aware did not make use of them 71.4%
 - Of those who did not find them helpful 50%
- When questioned on which Construction management skills they used the respondents answered as follow:
- Those who planned what resources were required for projects 15. 75%
 - Those who arranged and organized the resources needed for and used on projects 16. 75%
 - Communicated requirements to lead and motivate the various human resources involved on projects 68.4%
 - Estimated the cost of projects, prepared budgets and ensured that costs did not exceed the budgets 60.0%
 - Coordinated requirements, led and motivated the various human resources on a project 19. 55%
 - Managed the design process 30%
- Major problems
- Lack of finance (31.6%),
 - Securing work (21.1%)
 - No capital (12.5%)
 - Poorly trained workers (11.8%)
 - Lack of continuity (10.5%)

The trend suggests that lack of finance and capital was most problematic. Key aspects supporting businesses growth:

- Finance (31.6%)
- Training/training workshops (31.6%)
- More tender opportunities (15.8%)
- Better customer service, Simplification of tender documentation and Possessing sufficient tools (15.4% each)
- More tender opportunities (11.8%)
- Improved communication skills (11.8%)

Key training needs:

- Financial management (53.3%)
- Project management (25.0%)
- Estimating and tendering (21.4%)
- Business management skills (18.8%)
- Financial management (14.3%)
- Financial management (12.5%)

- Basic training in surveying and levels (13,3%)

Other findings were that women-owned contractors still employ three times more males than females in their organizations. This practice perpetuates the male domination that is complained about (Haupt & Fester 2010). The reason for this is possibly that men are still regarded to have the competencies required and that there is the expectation of transfer of skills.

9. Delegate views and lessons learnt

The delegates agreed that the selected sample of CIDB gradings 1-4 made sense. The cidb pointed out that level 1 is part of special programmes like the Expanded Public Works Programme (EPWP) and that the cidb focus is from grade 2 upwards. The aim is for quality assurance and not to move vast numbers through the grades. Some of the most important lessons learnt are summarised as follows:

- In order for an enterprise to be sustainable an entrepreneur has to have at least 50% of the value of the contract available up front.
- Understand construction and gain some experience on site working with success models before trying to register with the cidb. Women are best placed to help women and the successful ones should reach out to the upcoming women entrepreneurs.
- There are certain myths in construction and that is that success is to reach level 8 or 9. That is not true as one can be successful in each grade as you achieve quality projects within time and budget and other goals set for the specific enterprise by the owner. Khuthaza is proposing a study into myths in the construction industry.
- All participants agreed that each enterprise should set appropriate goals that are achievable in their specific environment and that success should not be seen as moving of all women-owned enterprises through to level 9.
 - It was suggested that the CIDB register is one of the most reliable to report on where women are applied in the industry looking at their enterprise register and their project register. Consider the gaps and thus look at alleviating bottlenecks. Neutral web-site (e.g. DBSA) with information for women-owned enterprises was requested.
 - Similarly it was regarded as important to have an integrated career-focused training programme aligned to the needs of women entrepreneurs at various levels and own environments for the sustainable development of their enterprises. Goal setting in terms of their vision for their enterprises and careers were likewise viewed as important.
- It was noted that the Construction Industry Training Authority (CETA) is encouraging innovation in skills training and that there is a drive to have rather less contractors who are able to do quality work than vast numbers who are not skilled. The emphasis is on quality rather than numbers and training should never take place without a project where the training can be practically applied.

- For meaningful progress with empowering women-owned enterprises CETA is urged to co-ordinate training in business, technical, supervisory and legislative management training relating to unit standards. Where is it offered and are there unit standards for those areas?
- Mentors and coaches can be helpful in setting goals for the specific enterprises. An important aspect to be considered in goal setting is why the women entered in construction in the first place. The aim is to set career paths for women-owned enterprises at the various levels and to link them to appropriate learning programmes and study materials.
- The problems with procurement and malpractices experienced by the women-owned enterprises were noted. The women entrepreneurs need to report those. Support from the women associations and support organisations including the cidb are vital to overcome unethical behaviour and malpractices. Those who behave unethically spoil it for other upcoming construction entrepreneurs.
- Women enterprises are encouraged to earn respect through a good ethical learning attitude and good quality work.
- South African Federation of Civil Engineering Contractors (SAFCEC) from their endeavours in empowering women-owned enterprises noted the need for quality assurance for small contractors and will liaise with cidb to learn from their quality assurance framework for the upper grades.

10. CONCLUSIONS

It is acknowledged that the decline in the construction industry impacts negatively on all in the built environment, but that women are most adversely affected as the obstacles depicted in the leaky pipeline graph (CEWS 2006) will take longer to be removed. On the positive side never was there a better time while there is a slow-down to come up with a dedicated strategy and intervention to address the findings of this study. It is clear that women-owned enterprises are in construction for the right reasons and want to grow their businesses along the Four-Growth-Perspectives model. From this study and the various other studies underpinning its findings, it is clear that the under-representation of women in the higher grades of the cidb is due to a lack of integrated career-focused training programmes aligned to the needs of women entrepreneurs at various levels of their development and flexible to allow for their dual roles as mothers and career / business women.

11. RECOMMENDATION

It is recommended that the obstacles identified in this study be addressed through special strategies and interventions such as integrated career-focused training programmes aligned to the needs of women entrepreneurs at various levels of their development and flexible to allow for their dual roles

as mothers and career / business women. A country-wide roll out of the pilot project 'Women-helping-Women', learning from those lessons, is viewed as an appropriate intervention to benefit SA women-owned enterprises in construction. The lessons learnt from these projects should be captured and the projects used to encourage other stakeholders to prioritise women in their projects and programmes.

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ASOCSA2011-62

Key performance indicators reflecting the condition of the construction industry

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ABSTRACT

Purpose of this paper

Annual monitoring of the condition of the South African construction industry by using construction indicators is vital to enable government and other role players to evaluate the impact of current interventions for timely and pro-active implementation of revised legislation, strategies and development programs to act as an updated roadmap for the future well-being and growth of the industry.

Methodology

A database with contact particulars of employers, contractors and agents involved in 2807 projects completed in 2009 was compiled. Three separate survey forms were faxed or e-mailed to the contractors, employers and agents of these projects. Their responses were captured in a Microsoft Access database.

Findings

The main findings were that only 52% of all contractors were paid on time. The national departments and public corporations improved with regard to timeous payment compared to the previous survey. The overall performance of the majority of employer bodies was not satisfactory. Employers were satisfied with the overall performance of their agents and contractors. Some employer bodies allocated many tenders without considering the quality of the contractors. There was a strong indication of political intervention in the adjudication of tenders.

Value of the paper

This research contributes to the understanding of the construction industry and highlights existing problems to solve on the way forward. Government can make use of the results obtained to timely and pro-actively implement revised legislation, strategies and development programs to ensure the well-being and growth of the industry.

Keywords: construction industry indicators, key performance indicators.

1. INTRODUCTION

The Construction Industry Development Board (cidb) Act (Republic of South Africa, 2000) was passed in 2000 to establish a statutory body aimed at driving an integrated construction industry development strategy. This body was necessary as the construction industry plays an indispensable role in the South African economy by providing the physical infrastructure which is fundamental to the country's development.

Construction Industry Indicators (CIIs) have been developed by the Department of Public Works and the cidb with the assistance of the CSIR (van Huyssteen, van Heerden, Perkins and Gyimah, n.d.: Online) to play a useful role in developing a sustainable industry and to be adopted as a tool for improving performance in the South African construction industry. The CIIs of the cidb rely heavily on international experience and particularly those indicators adopted in the United Kingdom. In the United Kingdom the first Key Performance Indicators (KPIs) were published in 1999 in response to the Rethinking Construction report by Egan (1998).

Cost, time and quality are the three basic and most important performance indicators in construction projects, followed by others such as safety, functionality and satisfaction (Chan and Ada, 2004: 203-221). Based on the Egan report the Movement for Innovation and Construction Best Practice Programme (CBPP) was formed and is now recognised as a leading organisation involved in the production of KPIs within the industry (Beatham, Anumba and Thorpe, 2004: 93-117). The KPIs launched by the CBPP are: client satisfaction, product and service, profitability, productivity, defects, safety, construction time and construction cost.

The cidb CIIs measure the performance of the South African construction industry by measuring employer satisfaction with the project milestone dates achieved, construction costs versus tender amount, contractors' performance, agents' (consultants') performance, and the quality of materials used. The contractors' satisfaction is measured by profitability, the performance of the employer and his agents, the quality of the contract documentation, the management of variation orders and claims, payment delays and the performance of their materials suppliers.

The procurement indicators measured are obtained from the agents involved and include contractor performance issues utilised in the adjudication of tenders, the type of procurement procedure used, and the contracting strategy adopted.

The literature survey shows that it is mainly in the United Kingdom and South Africa where key performance indicators are used to monitor the

condition of their construction industries. These indicators are used as a tool to improve industry performance.

Annual monitoring of the condition of the South African construction industry by using construction indicators is vital to enable government and other role players to evaluate the impact of current interventions for timely and pro-active implementation of revised legislation, strategies and development programs to act as an updated roadmap for the future well-being and growth of the industry. This is the purpose of this research. The cidb CIIs described above have been captured since 2003 and this report is part of a series of annual papers (Marx 2009) presenting the results of this continuous survey project. It is a report on the results of the 2010 survey for projects completed in 2009.

2. METHODOLOGY

A database, with contact particulars of employers, contractors and agents involved in 2807 projects completed in 2009, was compiled. Three separate survey forms were faxed or e-mailed to the contractors, employers and agents of these projects. Their responses were captured in a Microsoft Access database. The average perspectives of the respondents were determined for different project types, employer categories and provinces. All questionnaires made used of the scale as shown in Table 1 to measure satisfaction levels.

Table 1: Definition of the % satisfaction levels

Dissatisfied			Neither Satisfied nor Dissatisfied				Satisfied		
10	20	30	40	50	60	70	80	90	100

It was found that the distribution of survey responses received was well distributed between different project types, employer categories, the financial grades of contractors and the provinces.

3. SCOPE

The CIIs used were only mainline indicators. Questions were not asked to pin-point the exact reasons for all problems experienced. The CIIs considered were only the project related indicators.

From the 2807 completed projects in the database, the contact particulars of 2807 contractors, 2624 employers and 1520 agents were available. Survey forms were received back from 1053 contractors, 434 employers and 445 agents reflecting response rates of 37,5%, 16,5% and 29,3% respectively.

4. DISCUSSION OF THE SURVEY RESULTS

a. Contractor profitability per project type

Table 2 indicates the distribution of contractor profitability for different project types and shows that for 3% of all the projects completed the contractors made a loss. The project types, with the highest percentage of projects with profitability of more than 15%, were special work (24%) and mechanical work projects (32%).

If the percentage of projects completed with 11-15% and more than 15% profit are combined for each project type, the results show that non-residential building projects were less profitable than all other project types. This may be due to the complexity of non-residential building projects and the large number of parties involved.

Table 2: Profitability of projects per project type 2009

Profitability	% of Projects in each Project Type						% of all Projects
	Residential Building	Non-residential Building	Civil Work	Mechanical Work	Electrical Work	Special Work	
Loss	6	3	5	3	0	1	3
0 – 5%	29	36	23	18	19	13	24
6 – 10%	27	40	38	34	41	15	36
11 – 15%	21	9	20	13	28	47	21
>15%	17	12	14	32	12	24	16
	Project Type						

b. Performance of the employer and the employer's agents

The contractors' satisfaction with the employer and agents (consultants) was tested with regard to overall performance, the quality of the tender documents and specifications, and the management of variation orders and claims. Table 3 shows the results obtained. The best overall employer categories were public private partnerships and public corporations with an average satisfaction level of 86% and 83% respectively, followed by provincial departments and regional / district councils each with an average satisfaction level of 78%. The worst overall performance was achieved by the private sector, national departments and metropolitan councils each with an average satisfaction level of 76%. Bearing in mind that a score of 80% means satisfied, the lowest score achieved is of no concern.

Table 3: Contractors' level of satisfaction with the employer's and agent's performance 2009

Performance	Average Satisfaction Level %						
	Employer Overall	76	83	76	78	76	78
Agent Overall	75	81	75	78	77	80	85
Documentation / Specifications	75	83	79	79	77	82	86
Management of VO's	78	80	74	76	74	83	90
Management of claims	77	79	74	74	73	76	90
	Private Sector	Public Corporation	National Department	Provincial Department	Metropolitan Council	Regional / District Council	Public Private Partnership
	Employer Category						

The average overall performance of the agents, in the eyes of the contractors, was slightly lower than the performance of the employers for most of the employer categories. The contractors were on average satisfied with the quality of the documentation and specifications provided by the public corporations, regional / district councils and public private partnerships. The other employer categories received a slightly lower score.

The contractors' satisfaction levels for the management of variation orders (VO's) were the lowest for national departments (74%) and metropolitan councils (74%). The national departments, provincial departments and metropolitan councils received the lowest scores of 74%, 74% and 73% respectively for the management of claims.

c. Contractor payment delays

The average number of days delay between certification and receipt of contractor payment of interim and final certificates is shown in Table 4.

The different contract documents used for projects had different requirements regarding timeous payment of certificates, but payment within a month was considered to be reasonable. It is of great concern that only 52% of all contractors were paid on time (< 30 days). However, there has been some improvement in this figure if compared with the 42% obtained from the previous annual survey.

With regard to early payment, the regional / district councils performed the worst, with payments made within 30 days on only 37% of their projects. The best performing client categories with 64% and 60% of project payments made within a month were public corporations and national departments respectively. The public corporations and national departments both paid their contractors on time (< 30 days) on 23% more of their projects compared to the previous survey. On the other hand the

metropolitan councils, regional / district councils and public private partnerships performed worse than during 2008.

Table 4: Days delay between certification and payment of contractors 2009

Avg. Days Delay	% of Projects in each Employer Category							% of all Projects
	Private Sector	Public Corporation	National Department	Provincial Department	Metropolitan Council	Regional / District Council	Public Private Partnership	
≤ 14	10	15	9	8	6	1	3	9
14 to 30	44	49	51	40	38	36	43	43
30+ to 60	34	27	28	32	41	43	37	34
60+ to 90	6	5	9	14	12	12	3	8
90+ to 120	4	1	1	3	1	1	14	3
120+	2	3	2	3	2	7	-	3
Project Type								

The worst performing employers were the provincial departments and regional / district councils who paid 20% of their contractors only after 60 days. There has been some improvement in the performance of national and provincial departments who respectively paid 3% and 6% of their contractors only after 90 days when compared with the 23% result obtained for both from the previous survey.

Contractors refrain from standing up to their contractual right to be paid on time for fear of losing job opportunities in the future. This creates major cash flow problems for contractors and the cidb should communicate this with client bodies.

These payment results are also shown in Table 5 as timeous payment (< 30 days) per employer category in different provinces. The results are disturbing as many employer bodies in various provinces pay only 0 to 30% of their contractors on time.

Table 5: Timeous payment (< 30 days) of contractors per province and employer category 2009

Employer Category	% of Projects where Contractor is paid within 30 days							
Private Sector	61 (28)	60 (5)	42 (81)	46 (78)	72 (36)	66 (29)	37 (19)	0 (5)
Public Corporation	56 (16)	50 (4)	64 (28)	57 (28)	92 (38)	56 (16)	79 (14)	11 (9)
National Department	64 (11)	50 (2)	33 (9)	73 (11)	57 (7)	50 (2)	75 (4)	100 (3)

Provincial Department	38 (32)	60 (5)	28 (18)	69 (29)	50 (18)	45 (20)	43 (7)	0 (2)
Metropolitan Council	34 (24)	40 (10)	38 (34)	52 (25)	80 (5)	63 (8)	67 (6)	0 (5)
Regional / District Council	77 (13)	33 (9)	-	26 (19)	71 (7)	0 (2)	13 (8)	0 (9)
Public Private Partnership	80 (5)	0 (6)	83 (6)	61 (33)	0 (4)	0 (9)	-	-
The value in brackets is the number of projects involved	Eastern Cape	Free State	Gauteng	KwaZulu-Natal	Limpopo	Mpumalanga	North West	Northern Cape
	Province							

d. Performance of materials suppliers

Contractors were requested to indicate their overall satisfaction level with their materials suppliers, the ability of the suppliers to keep to their quoted/agreed upon delivery schedules and whether the materials delivered on site complied with the specifications. The results are indicated in Table 6.

The materials suppliers for electrical and special work projects received a satisfactory score for their overall performance as well as for their delivery. For all the other project types the score was slightly less than 80%. The contractors for all project types were satisfied that the materials complied with the specification.

Table 6: Materials suppliers' performance per project type 2009

Contractors' Level of Satisfaction % with the Materials Suppliers for each Project Type						
Overall Performance	79	78	79	78	85	85
Keep to agreed upon Delivery Schedule	78	78	77	78	83	88
Material delivered as per Specification	83	82	82	81	86	85
	Residential Building	Non-residential Building	Civil work	Mechanical Work	Electrical Work	Special Work
	Project type					

4.5 Contractor performance issues utilised in the adjudication of tenders

Agents were requested to indicate which contractor performance issues were taken into account during the tender adjudication process and the results are indicated in Table 7 for different employer categories.

Table 7: Contractor performance issues used in the adjudication of tenders 2009

Performance Issues	% of Projects in each Employer Category using different Performance Issues						
	Financial offer	31	16	17	10	5	11
Financial offer and preference	14	23	53	38	54	50	22
Financial offer and quality	21	11	3	12	6	4	34
Financial offer, quality and preference	34	50	27	40	35	35	33
	Private Sector	Public Corporation e.g. ESKOM, ACSA	National Department	Provincial Department	Metropolitan Council	Regional / District Council	Public Private Partnership
	Employer Category						

Table 7 shows that even the private sector incorporated preference in 48% of all their projects. No longer are price and quality the only issues evaluated, and tender allocation based on financial offer, quality and

preference was most popular (34%). Table 7 shows that there were still a large number of projects where financial offer and preference were the only criteria used to allocate tenders. It is alarming that financial offer and preference were the only criteria considered in 53%, 38%, 54% and 50% of projects for national and provincial departments, metropolitan councils and regional/district councils respectively. In other words, the quality i.e. capability, training, performance and track record, of the contractors, were considered as being of no importance to select a contractor to do work for the employer. This political strategy to support and build emerging contractors should be re-evaluated by government.

4.6 Deviation from the tender adjudication procedures

Agents were posed the question whether the employer awarded the tender to the responsive tenderer who achieved the best tender score during the tender evaluation process. The tenders were evaluated by the agents according to the employer's own approved tender evaluation procedures. Non-responsive tenders received were ignored. Table 8 shows the

Table 8: Contracts not awarded to the tenderer with best tender score per province 2009

Employer Category	% Contracts not awarded to the responsive tenderer with best tenderer score								
Private Sector	8 (13)	33 (3)	26 (29)	32 (22)	25 (8)	33 (9)	25 (12)	40 (5)	18 (11)
Public Corporation	11 (9)	0 (2)	14 (14)	8 (13)	0 (2)	17 (6)	0 (1)	0 (2)	14 (7)
National Department	0 (4)	0 (2)	0 (5)	0 (4)	17 (6)	0 (3)	-	-	0 (7)
Provincial Department	13 (16)	-	0 (1)	8 (13)	54 (13)	56 (9)	25 (4)	25 (4)	13 (8)
Metropolitan Council	14 (14)	8 (12)	4 (25)	26 (23)	25 (8)	0 (6)	5 (20)	0 (3)	3 (31)
Regional / District Council	20 (5)	100 (1)	-	11 (9)	-	33 (3)	0 (2)	0 (3)	0 (4)
Public Private Partnership	0 (3)	-	33 (3)	0 (2)	-	-	-	0 (1)	-
The value in brackets is the number of projects involved	Eastern Cape	Free State	Gauteng	KwaZulu-Natal	Limpopo	Mpumalanga	North West	Northern Cape	Western Cape
	Province								

percentage of contracts that were not awarded to the responsive tenderer with the best tender evaluation score per employer category and province. The provincial departments of Limpopo and Mpumalanga respectively overruled tender recommendations in 54% and 56% of their tenders awarded. The results are disturbing, bearing in mind that they are not based on the perceptions of the aggrieved tenderers, but on the knowledge of the independent agents of the employers. This suggests that there may

be some form of political intervention, manipulation of results or corrupt / fraudulent practices. The national departments, except in the Limpopo province, performed very well. Table 8 shows for which employer categories tender adjudication practices should be investigated.

4.7 Construction commencement milestone dates

Table 9 shows the percentage of projects with the project commencement and completion dates achieved for different project types. It is not known whether the reason for a late start was due to contractors who could not produce their guarantees on time, or employers who did not have the sites ready to hand over to the contractors. Table 9 shows that 96% of all projects started on time and 87% of all projects finished on time. The finish on time date included any normal extension of time allowed for by the contract. Only 79% of the mechanical projects finished on time. This is the project type with the lowest performance. It is not known if the reason for late completion is lack of contractor capacity, managerial skills, finances, know-how or perhaps unrealistic construction periods specified by agents or employers.

Table 9: Project start and completion milestone dates 2009

Project Type	Start on Time %	Finish on Time %
Residential Building	96	85
Non-residential Building	95	84
Civil Works	98	90
Mechanical Works	95	79
Electrical Works	94	89
Special Works	100	87
Overall	96	87

1.8 Employer satisfaction

Table 10 shows the average level of employer satisfaction for different project types. These are the performance levels of their agents and contractors and the quality of materials used. Bearing in mind that a score of 80% means satisfied, Table 10 shows that employers were satisfied with the overall performance of their agents, and their contractors and the overall quality of materials used on site. Residential and non-residential building projects received the lowest score (79%) for defect free work at practical completion. Mechanical work projects received the lowest satisfaction level (79%) for the contractor's ability to finish on time. Generally speaking the average satisfaction levels expressed by the employers were high.

Table 10: Customer satisfaction 2009

Project Type	Employers' Level of Satisfaction % with						
	Overall performance of Agents	Overall performance of Contractor	Ability of Main Contractor to finish on time	Quality of Completed Work	Main Contractor's Resolution of Defective Work	Work Defect free at Practical Completion	Overall quality of Materials used
Residential Building	81	84	83	84	83	79	86
Non-residential Building	82	82	81	83	82	79	85
Civil Works	82	83	83	84	83	82	86
Mechanical Works	83	82	79	84	81	82	85
Electrical Works	83	84	84	87	86	84	87
Special Works	87	84	83	85	84	84	87

5. CONCLUSIONS AND RECOMMENDATIONS

The main findings of the 2010 survey for projects completed in 2009 were as follows:

- 1) Contractors made a loss on 3% of all projects completed. Mechanical work (32%) and special work projects (24%) showed the highest percentage of projects with contractor profit of > 15%.
- 2) The overall performance of the majority of employer bodies and agents was just below satisfactory.
- 3) National departments and metropolitan councils received the lowest score for the management of variation orders (74%). National and provincial departments received a 74% score for the management of claims with the metropolitan councils scoring the lowest at 73%.
- 4) Only 52% of all contractors were paid on time, within 30 days, with the metropolitan and regional/district councils being the worst performers. This 52% is an improvement on the result of the previous survey (42%). Public corporations and national departments improved on timeous payments compared to the previous survey.
- 5) It is of great concern that contractor quality was discarded as being of no importance in 53%, 54% and 50% of tenders allocated for national departments, metropolitan councils and regional/district councils respectively.
- 6) There is a strong indication of political intervention in the tender adjudication procedures of many employer bodies.
- 7) Only 79% of mechanical works projects were finished on time.
- 8) Employers were satisfied with the overall performances of their agents and contractors and the quantity of materials used.

It is recommended that this research be continued and improved annually in order to track trends over time.

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THE USE OF COMMUNITY LABOUR IN SOUTH AFRICAN CONSTRUCTION

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ABSTRACT

Purpose: The research addressed issues that affect the use of community labour in South African construction since the use of community labour is reportedly resulting in a range of consequences such as sub-standard quality outputs and cost overruns that eventually damage the image of the industry.

Design / Methodology / Approach: A quantitative research survey was conducted among general contractor (GC) members of the Eastern Cape Master Builders Association based in the Nelson Mandela Bay Metropolis in order to generate the primary data that was underpinned by a review of related literature.

Findings: A key Finding that arose from the study indicate that the respondents perceive that the use of community labour negatively affect the quality standard of construction activities such as plastering, tiling, brickwork, carpentry and joinery so much so that rework become inevitable in the construction process.

Practical implications: The key issue here is that though community labour initiatives has a lot of advantages, it tend to work counter productive against it intended objectives when it is poorly implemented by poorly informed project stakeholders.

Originality / Value: The research highlight issues relative to a key government initiative that is met to create more jobs and increase the level of available skilled labour in South African construction.

KEYWORDS: Community labour, Construction, Quality standard, South Africa

1.0 BACKGROUND

Over the years there have been extensive and complex projects completed through the use of community labour based methods. Intensive labour creates great opportunities such as the reduction in the unemployment rate, skills development and the development of the country. It is notable that South Africa needs to implement plans to reduce unemployment, as the unemployment rate has been on the upward swing for the past two decades. Therefore, one of the acclaimed ways to stem the growth of unemployment is through the use of labour intensive construction for project execution. However, with the increase in labour intensive projects comes the decrease in skill deficiencies in disadvantaged communities. Thus, it is important that labour intensive projects do not become projects where the construction work needs to be redone to achieve the desired quality, as this increases construction costs and decreases quality and profit (Thwala, 2005).

In addition, in the last decade there has been evidence of a decline in the quality of workmanship in the construction industry (Department of Cooperative Governance and Traditional Affairs, 2009). This decline in quality of workmanship, in turn, affect the quality of completed projects as there is a link between the quality of materials, tools and the skills of labour used in executing projects. That is, high quality standard achieved on projects may be deemed to be due to the appropriate use of skilled labour, materials and equipment (Gann, 2000). This relationship between skilled labour and quality brings to the fore the importance of using appropriately qualified workers for project execution.

Most importantly, the quality standard of works executed have the tendency to affect project parameters of cost, time, and health and safety (H&S) internally, and also affect the reputation of organisations involved in the project externally (Oakland, 2003). This is even more imperative as the measure of quality performance is determined by the level of satisfaction expressed by clients with respect to a product / service / project (Oakland, 2003). According to Pribadi (2000), the primary reason for poor quality is poor workmanship or incompetence associated with skilled or unskilled labour. A part from the monetary cost of poor quality, other cost of quality identified in the literature include poor reputation and image that may become compounded or pronounced with dissatisfied clients (Thorpe, 2004).

In the South African construction context therefore, in spite of the benefits that may be attributable to community labour construction practices, the decline in the number of skilled artisans exiting and entering the industry is so disproportionate that it has become a source of concern for industry stakeholders (McGrath *et al.*, 2004; Erasmus and Breier, 2009). To be succinct, the intent of this paper is to provide more insights into the effects the use of community labour has on quality standards achieved in the construction process, and also the reputation of contractors that have to use community labour as mandated by their project requirements.

2.0 LITERATURE REVIEW

After the 1994 elections, the Government initiated the National Public Works Programme (NPWP) to increase training through the National Skills Development Strategy (NSDS) and labour intensive construction. The NPWP therefore shifted its focus to a Community Based Public Works Programme (CBPWP), which places emphasis on using smaller construction companies and regulatory bodies rather than a national programme (Thwala, 2005).

However, the implementation of the national program 15 years leading up to 2005 has not been impressive. Though significant amount was reportedly spent on projects with the intention to provide infrastructure and at the same time create employment, a commensurate success was not achieved. Added to these objectives was the enforcement of the use of local labour from nearby local communities. Specifically, Thwala (2005) reported that the most common causes of failure in public works programmes include:

- Not in relation to the national manpower needs;
- Poor introduction and functioning systems;
- Use of inappropriate technology;
- Unrelated to overall development policy;
- Lacking administrative support;
- Lacking maintenance proceeding the project, and
- Dependent on Government's commitment.

While the aforementioned problems contribute to the failure in various degrees, anecdotal and empirical findings suggest that manpower related issues could have contributed the most to the failure (Merrifield, 2006).

2.1 Contributing factors to the lack of skills in South Africa

During the apartheid regime the South African government provided job creation schemes, though they were not related to any economic growth strategies. This meant that jobs were created for the unemployed, this however, was short-term employment which provided no training and limited development of skills. Due to the limited development of labourers' skills, there were no opportunities to transfer skills. This reduced the prospect to provide the labourers with numerous employment opportunities. This also meant that the labourers had no proof of skills that they developed; as a result of this there are no opportunities for unskilled labourers to enter the formal training sector (McGrath *et al.*, 2004). Thus, the apartheid regime created situations that whereby most unskilled employment was mainly occupied by black workers. The main reason for this was that during the apartheid regime black workers were tightly controlled and had limited rights. Black South Africans were forced to occupy the less skilled jobs constituting cheap labour, while the white employees controlled the skilled and managerial positions earning higher wages. Black workers who were paid hourly were on different payrolls, their benefits were different from that of white workers who were paid hourly (von Holdt, 2003).

Further, the situation after the end of the apartheid regime has not changed significantly as problems due to shortage of skills may have been amplified by the perceived loss of intellectual capital as a direct result of the high turnover of employees; and the loss of skills due to the departure of experienced staff that mentor new entrants into the industry (cidb and CSIR, 2007). These reasons inevitably eventuate in a decrease in skills development and availability of skilled labour in the South African construction industry. For instance, inadequate number of artisans is evidenced in the industry due to the lack of apprenticeships provided by employers over the years (Erasmus and Breier, 2009). A contributing factor has been the phasing out of apprenticeships at the Olifantsfontein Training Centre and the implementation of the new Construction Education and Training Authority (CETA). This has led to a notable decline in the number of persons entering apprenticeships (Dupper and Garbers, 2009). The flaw with the new learnerships is that they favour the employed in the formal economy as it requires a compliant employer. This eliminates the unemployed which is made up mainly of the youths (Brown, 2005).

Overall these shortcomings affect quality standard achieved in community labour projects, and therefore, lower the attractiveness of labour intensive construction methods. For example, in a multi-case study investigation conducted by Musekene (2010), it was discovered that the programme had an inherited lack of capacity due to shortage of skills with a large pool of unskilled project participants who required training. It was found that limited project management skills compounded by inadequate knowledge of labour-intensive management and supervision hindered the performance of the sampled programmes. As a result, some projects were forced to change the construction methods from labour-intensive to capital-intensive so as to meet the set project targets. In particular, with respect to the involvement of community members in labour-intensive construction, the data from the sampled projects indicated that the demand for unskilled labour within the sampled project areas was very low when compared to the incidence of poverty that was extremely high. Therefore, the projects targeted a large proportion of highly unskilled women participants over the age of 40 years as opposed to their intended objective of attracting young people.

Similarly, in the case of Alexandra Urban Renewal Projects, Thwala (2006) contends that the project failed to create the full potential numbers of jobs due to the failure to apply labour-intensive construction methods on the projects. While citing a number of reasons for the failure, Thwala (2006) noted that in South Africa, projects with similar objectives have not been as effective. However, the Amadiba road project is a clear departure from the poor performance that is associated with labour-intensive construction methods (Mashiri *et al.*, 2005). The positive impact on the socio-economic trajectory of the Amadiba community in general, and those fortunate to have participated in the construction of the projects underscores the need to promote labour-intensive construction methods in South Africa.

3.0 THE RESEARCH

Given that this paper presents findings based on a quantitative survey method that employed the use of descriptive statistics for analysis, the use of mean comparisons is considered appropriate for presenting the results. In this sense, the likert-scale type questions are discussed based upon a mean score (MS) comparison as indicated in Table 1. The ranges in Table 1 are computed based on the fact that all the likert-scale type questions used in the research were five-point in extent. Therefore, the difference between the upper and lower ends of the scale is 4.00 since there are five points. Hence, each range is 0.80 in extent as determined by the division of 4.00 / 5. As part of the likert-scale type questions, 'unsure' options and 'does not' options were provided so that respondents with divergent views can record their perceptions. In this sense, the 'unsure' options enabled respondents to indicate that the answer to the questionnaire is not certain based on his / her perception, while the 'does not' option enabled respondents to refute the statement.

Table 1 Terms used to discuss mean score comparison

Mean score range	Meaning
> 4.20 ≤ 5.00	Near major extent to major extent
> 3.40 ≤ 4.20	Some extent to near major extent
> 2.60 ≤ 3.40	Near minor extent to some extent
> 1.80 ≤ 2.60	Minor to near minor extent
≥ 1.00 ≤ 1.80	Less than minor to a minor extent

3.1 Results

Based on the findings in the literature, a survey was therefore conducted among general contractor (GC) members of the Eastern Cape Master Builders Association. Seventy seven (77) organisations were sent the

structured questionnaire that elicited for information relative to community labour. At the end of the survey, only 11 valid responses were received, which equates to a response rate of 14.3%. The low response rate was recorded in spite of efforts directed toward achieving higher response rate. For instance, though the initial questionnaire was posted to respondents, polite follow-up emails were sent at convenient intervals as reminders. In particular, out of the 77 questionnaires sent out, nine (9) were returned back to sender (RTS), while one (1) was incomplete. Therefore, the 9 RTS and 1 invalid response contribute to the low response rate recorded.

Though, the research investigated a range of issues related to the use of community labour in South African construction, only issues relative to quality are reported upon in this paper. To this end, Table 2 indicates the respondents' perceptions of the effects community labour has on quality of different construction activities in terms of percentage responses to a scale of 1 (minor) to 5 (major), and a mean score (MS) ranging between 1.00 and 5.00. It is notable that 11 out of the listed construction activities have MSs above the midpoint score of 3.00, which indicate that in general the respondents can be deemed to perceive that community labour have more of a major than a minor effect on these activities.

The MSs $> 3.40 \leq 4.20$ suggest that the respondents can be deemed to perceive that community labour have between some effect to a near major effect / a near major effect on plastering, tiling, rework, brickwork, carpentry and joinery, plumbing, ceiling, and mechanical work in South African construction; the MSs $> 2.60 \leq 3.40$ suggest that the respondents can be deemed to perceive that community labour have between a near minor effect to some effect / some effect on paintwork, roof covering, and concrete works in South African construction; while the MS < 1.80 suggest that community labour has a minor effect on earthworks and site establishment activities in South African construction. According to Table 1 therefore, plastering, tiling, rework, brickwork, carpentry and joinery, plumbing, and ceiling are ranked 1st, 2nd, 3rd, 4th, 5th, 6th and 7th in terms of the effects community labour on quality of different construction activities listed in the table.

Construction activity	Response (%)							MS	RANK
	Unsure	Does Not	Minor Major						
			1	2	3	4	5		
Plastering	0.0	0.0	0.0	18.2	0.0	45.5	36.4	4.00	1
Tiling	.1	0.0	0.0	9.1	18.2	18.2	45.5	4.00	2
Rework	0.0	0.0	0.0	10.0	20.0	40.0	30.0	3.90	3
Brickwork	0.0	0.0	9.1	9.1	18.2	27.3	36.4	3.73	4
Carpentry and joinery	18.2	0.0	0.0	9.1	18.2	27.3	27.3	3.73	5
Plumbing	18.2	0.0	0.0	9.1	18.2	27.3	27.3	3.73	6
Ceiling	18.2	0.0	0.0	18.2	9.1	27.3	27.3	3.64	7

Mechanical work	27.3	0.0	18.2	0.0	0.0	18.2	36.4	3.55	8
Paintwork	9.1	0.0	0.0	36.4	18.2	9.1	27.3	3.27	9
Roof covering	18.2	0.0	18.2	9.1	9.1	27.3	18.2	3.18	10
Concrete	0.0	0.0	9.1	27.3	27.3	18.2	18.2	3.09	11
Earthworks	0.0	0.0	45.5	8.2	36.4	0.0	0.0	1.91	12
Site establishment	9.1	18.2	27.3	18.2	27.3	0.0	0.0	1.73	13

Table 2 Effects of community labour quality output of construction activities

Table 3 indicates the respondents' perceptions of the extent the use of community labour inflates tender prices of a range of construction activities in terms of percentage responses to a scale of 1 (minor) to 5 (major), and a mean score (MS) ranging between 1.00 and 5.00. It is notable that only 3 out of the listed construction activities have MSs above the midpoint score of 3.00, which indicate that in general the respondents can be deemed to perceive that community labour have more of a minor than a major extent on tender price inflation.

The MSs $> 2.60 \leq 3.40$ suggest that the respondents can be deemed to perceive that community labour inflates tender prices relative to training of workers, considerations related to rework, project time, and penalties between a near minor extent to some extent / some extent, while the MSs $> 1.80 \leq 2.60$ suggest that the respondents are of the opinion that community labour inflates tender prices pertaining to labour factor in a rate, waste factor in a rate, maintenance of plant, overheads and insurance between a minor to near minor extent / a near minor extent.

Activity	Response (%)							MS	RANK
	Unsure	Does Not	Minor Major						
			1	2	3	4	5		
Training	0.0	9.1	9.1	9.1	9.1	54.5	9.1	3.18	1
Rework	9.1	9.1	9.1	18.2	9.1	27.3	18.2	3.00	2
Project time	9.1	9.1	0.0	18.2	27.3	27.3	9.1	3.00	3
Penalties	18.2	9.1	9.1	18.2	27.3	9.1	9.1	2.64	5
Labour factor in a rate	0.0	9.1	18.2	18.2	36.4	0.0	18.2	2.55	6
Waste factor in a rate	0.0	18.2	18.2	18.2	18.2	9.1	18.2	2.36	7
Maintenance of plant	9.1	27.3	18.2	0.0	9.1	27.3	9.1	2.27	8
Overheads	0.0	27.3	9.1	9.1	27.3	18.2	9.1	2.27	9
Insurance	9.1	18.2	18.2	27.3	18.2	9.1	0.0	1.91	10

Material factor in a rate	0.0	27.3	36.4	9.1	27.3	0.0	0.0	1.36	11
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Table 3 Effects of the use community labour on tender prices

Similarly, Table 4 indicates the respondents' perceptions of the extent the use community labour influences construction cost of a range of construction activities in terms of percentage responses to a scale of 1 (minor) to 5 (major), and a mean score (MS) ranging between 1.00 and 5.00. It is notable that only 2 out of the listed construction activities have MSs above the midpoint score of 3.00, which indicate that in general the respondents can be deemed to perceive that community labour influence on construction cost is more of a minor than a major.

The MSs $> 2.60 \leq 3.40$ suggest that the respondents can be deemed to perceive that community labour influences construction cost relative to training of workers, rework, project time, waste factor in a rate, penalties, and overhead between a near minor extent to some extent / some extent, while the MSs $> 1.80 \leq 2.60$ suggest that the respondents are of the opinion that community labour influences the construction cost of a range of construction activities such as labour factor in a rate between a minor to near minor extent / a near minor extent.

Table 4 Effects of the use of community labour on construction cost

neter	Response (%)							MS	RANK
	Unsure	Does Not	Minor Major						
			1	2	3	4	5		
Training	0.0	0.0	9.1	0.0	45.5	36.4	9.1	3.36	1
Rework	0.0	0.0	18.2	9.1	36.4	18.2	18.2	3.09	2
Project time	0.0	0.0	27.3	0.0	36.4	27.3	9.1	2.91	3
Waste factor in a rate	0.0	0.0	18.2	18.2	36.4	9.1	18.2	2.91	4
Penalties	9.1	9.1	9.1	18.2	18.2	27.3	9.1	2.82	5
Overheads	0.0	9.1	18.2	9.1	36.4	9.1	18.2	2.73	6
Labour factor in a rate	0.0	9.1	9.1	36.4	18.2	18.2	9.1	2.55	7
Maintenance of plant	9.1	9.1	36.4	0.0	18.2	18.2	9.1	2.36	8
Material factor in a rate	0.0	9.1	18.2	18.2	54.5	0.0	0.0	2.18	9
Insurance	9.1	18.2	18.2	27.3	18.2	9.1	0.0	1.91	10

Table 5 indicates the respondents' perceptions of the extent the use community labour negatively affect the scheduling of construction works in terms of percentage responses to a scale of 1 (minor) to 5 (major), and a mean score (MS) ranging between 1.00 and 5.00. It is notable that 10 out of the listed construction activities have MSs above the midpoint score of 3.00, which indicate that in general the respondents can be deemed to perceive

that community labour negative effects on the scheduling of these activities is more of a major than a minor.

The MSs $> 4.20 \leq 5.00$ suggest that the respondents can be deemed to perceive that community labour negative effect on mechanical work can range between a near major to major / major; the MSs $> 3.40 \leq 4.20$ suggest that the respondents can be deemed to perceive that community labour negative effects on rework, brickwork, tiling, plastering, carpentry and joinery, plumbing, and ceiling can range between some effects to a near major / near major; and the MSs $> 2.60 \leq 3.40$ suggest that the respondents can be deemed to perceive that community labour negative effects on concrete and earth works can be deemed to range between rare effects to some effects / some effects.

Table 5 Effects of the use of community labour on scheduling of works

neter	Response (%)							MS	RANK
	Unsure	Does Not	Minor Major						
			1	2	3	4	5		
Mechanical work	27.3	0.0	18.2	0.0	9.1	9.1	36.4	4.75	1
Rework	0.0	0.0	0.0	9.1	9.1	54.5	27.3	4.00	2
Brickwork	0.0	0.0	0.0	18.2	18.2	18.2	45.5	3.91	3
Tiling	9.1	0.0	0.0	9.1	18.2	27.3	36.4	3.91	3
Plastering	9.1	0.0	0.0	9.1	27.3	27.3	27.3	3.73	5
Paintwork	9.1	0.0	0.0	27.3	27.3	9.1	27.3	3.70	6
Carpentry and joinery	18.2	0.0	0.0	18.2	9.1	27.3	27.3	3.64	7
Plumbing	18.2	0.0	0.0	18.2	9.1	27.3	27.3	3.64	7
Ceiling	18.2	0.0	0.0	18.2	9.1	36.4	18.2	3.55	9
Roof covering	20.0	0.0	20.0	10.0	0.0	30.0	20.0	3.20	10
Concrete	0.0	0.0	9.1	18.2	54.5	9.1	9.1	2.91	11
Earthworks	0.0	9.1	36.4	9.1	45.5	0.0	0.0	1.91	12
Site establishment	0.0	45.5	18.2	9.1	27.3	0.0	0.0	1.18	13

Table 6 indicates the respondents' perceptions of the extent to which contractors hires different categories of community labour when contract requirements mandate them to do so in terms of percentage responses to a scale of 1 (minor) to 5 (major), and a mean score (MS) ranging between 1.00 and 5.00. It is notable that MSs above the midpoint score of 3.00 (2), indicate that in general the contractors will rather hire unskilled and semi-skilled labour whenever they are mandated to do so.

Table 6 hiring of different categories of community labour by contractors

Category	Response (%)							MS	RANK
	Unsure	Does Not	Minor Major						
			1	2	3	4	5		
Un-skilled	9.1	0.0	9.1	0.0	0.0	18.2	63.6	4.70	1
Semi-Skilled	9.1	9.1	0.0	27.3	27.3	18.2	9.1	3.10	2
Skilled	18.2	9.1	45.5	9.1	9.1	0.0	9.1	2.33	3

Table 7 indicates the respondents' perceptions relative to two community labour related aspects in terms of percentage responses to a scale of 1 (limited) to 5 (extensive), and a mean score (MS) ranging between 1.00 and 5.00. It is notable that the MSs are below the midpoint score of 3.00, which indicate that in general contractors perceive that skills improvement among community labour workers as well as retention of community labour workers when a project is over in their community is not likely. In addition, Figure 1 suggests that the majority (72.7%) of the survey respondents are of the opinion that community labour has a negative effect on the reputation of their organisation.

Table 7 Contractors perception of community labour related aspects

Aspect	Response (%)						MS
	Unsure	Limited Extensive					
		1	2	3	4	5	
Skills improvement post project	0.0	18.2	36.4	27.3	18.2	0.0	2.45
Employee retention post project	0.0	9.1	72.7	18.2	0.0	0.0	1.09

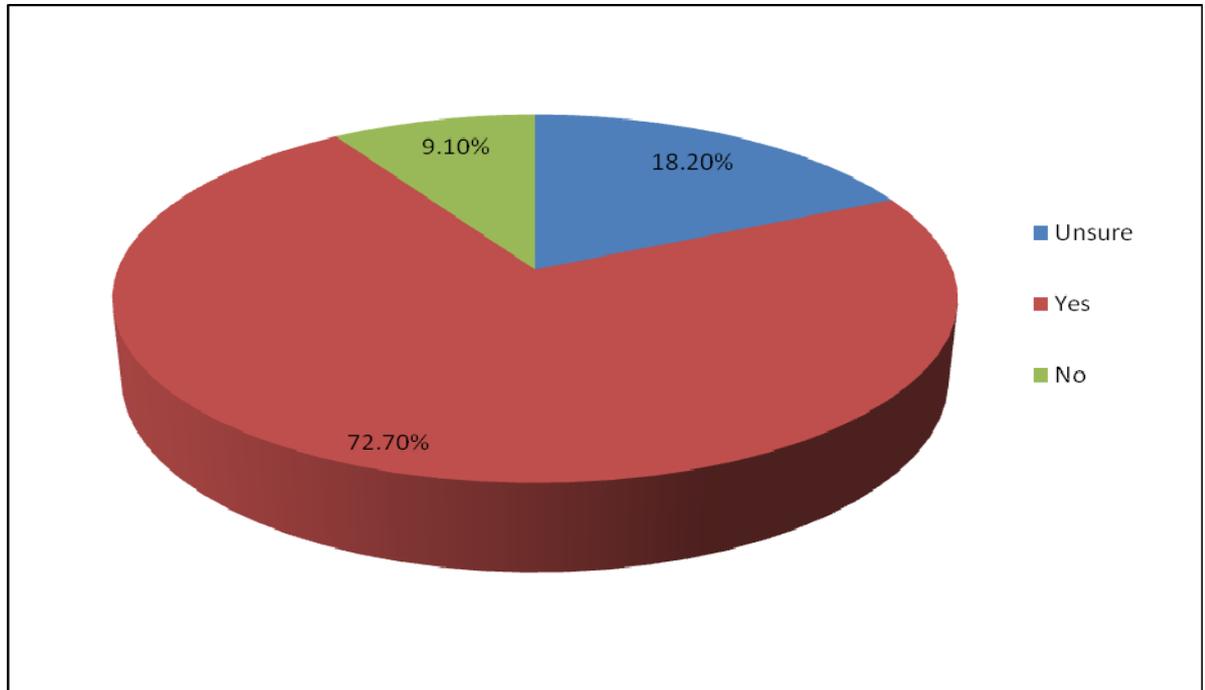


Figure 1 Effects of the use of community labour on the reputation of an organisation

3.0 CONCLUSIONS AND RECOMMENDATIONS

In brief, this paper has highlighted a range of issues pertaining to the use of community labour in South African construction. The research findings, which is primarily based on the perceptions of GCs based in the Eastern Cape Province, *inter-alia*, reveal that community labour negatively affects the quality standard achieved in a range of construction activities such as plastering, tiling, rework, brickwork, carpentry and joinery, plumbing, and ceiling; negatively affect the scheduling of a range of activities such as mechanical work, rework, brickwork, tiling, plastering, carpentry and joinery, plumbing, and ceiling; does not necessarily lead to improvement in the skills of community labour workers at the end of projects; and the likelihood of contractors retaining community labour workers in their employment at the expiration of a project is rather remote.

Though, limited by the response rate achieved, the research nevertheless observed that all is not well with community labour practices in South African construction based upon the perceptions of contractors that responded to the survey. Therefore, it is herein recommended that the whole process of engaging community labour should be revisited in order to map out positive way forward. In particular, all project stakeholders should be enlightened

about the intent of engaging community labour so that appropriate results can be achieved. The achievement of quality standard should be ensured in community labour construction projects with emphasis on construction activities that the skills level of community labour through their degree of workmanship may affect. In this context, construction activities such as plastering, tiling, brickwork, and carpentry and joinery should be closely monitored in community labour related projects. In addition, contractors should pay attention to issues that may give rise to time and cost overruns in community labour projects. Such issues, though not limited to, but include mechanical work, brickwork, and plastering. Most importantly, rework due to poor workmanship should be avoided in community labour projects.

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Education and training in Alternate Dispute Resolution in a South African context

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ABSTRACT

Purpose: Alternate dispute resolution (ADR) is increasingly becoming an important factor in the management of projects in the construction industry. The young professional is often faced with the challenge of managing differences and conflict within construction projects, be it small or large. The questions raised, have these professionals developed adequately to manage the inevitable risk of differences and disputes, how do they rate the importance of the education and training received and did the training fulfil their needs?

Design/methodology/approach: A literature review was conducted to determine the requirements of professionals facilitating ADR in the South African construction industry. Based on the findings, a questionnaire survey was conducted to determine whether young professionals/graduates are knowledgeable of the requirements, how they rate the importance of these requirements and is their education and training adequate to fulfil their needs in this regard.

Findings: Young professionals/graduates were found to have a good basic knowledge of the ADR concept however; the required skills and techniques for effective application need to be addressed.

Practical implications: The skills and ability of professionals, related to the management of differences and the application of ADR methods in the construction industry, may significantly reduce project dispute risk.

Keywords: Alternate Dispute Resolution, young professionals, education, training

1. INTRODUCTION

Young professionals enter the construction industry after graduating and are often tasked to manage a project which includes the management of claims and Alternate Dispute Resolution (ADR). According to Verster (2006:13), practice calls for the effective management of dispute risks and may have a correlation on how effectively dispute resolution methods are applied.

Due to the inevitable risk of dispute inherent in the construction industry, these professionals should have an understanding of the ADR context, methods and the skills required to facilitate conciliation in the project environment in order to manage a project effectively.

Some tertiary institutions address the ADR context in their curriculums in modules such as Construction Contracts Law and Professional Practice. Education and training in the industry is also addressed in the form of Continuous Professional Development.

The question raised; is an understanding of the methods of ADR sufficient for the young professional to perform this task successfully, or is it necessary to address the relevant attributes and skills for effective application.

The objectives of the paper are:

- To determine what the requirements of professionals facilitating ADR in the South African construction industry are.
- To determine the ADR tertiary levels amongst Quantity Surveying graduates in South Africa.
- To determine the ADR knowledge and practice levels of professionals in the industry.
- To determine how professionals perceive the importance of the ADR requirements.
- To determine the ADR competence levels of professionals who did not undergo formal education and training.
- To determine which ADR elements are not addressed in the syllabi at tertiary institutions.
- To recommend the action needed to improve education and training in ADR at tertiary institutions.

2. THE ALTERNATE DISPUTE RESOLUTION CONTEXT

According to Loots (1991: 8-13) and Verster (2006:13), ADR facilitators in the construction industry require an understanding of the application of the basic fundamental features of the non-adjudicative methods of ADR known as the Four Cs, which include the following:

- Consensus
- Continuity
- Control
- Confidentiality.

The effective application of the Four Cs will provide the basis for creating win-win outcomes.

3. METHODS

Finsen (2005: 32); Verster & van Zyl, (2007: 3); & Pretorius (1993: 2 – 5) identify the more common methods of ADR as:

- Arbitration
- Adjudication
- Negotiation
- Conciliation
- Mediation

Pretorius (1993: 6) suggests that the application of an appropriate dispute resolution method requires knowledge of the Alternate Dispute Resolution (ADR) processes and the ability to assess and compare the processes.

Young professionals may therefore require a good knowledge and understanding of the Alternate Dispute Resolution (ADR) context to fully implement the management of dispute in order to avoid differences developing into disputes.

The application of ADR in the construction industry differs from internationally practiced ADR (Brown & Marriott, 1993: 18-20; Boulle & Rycroft, 1997: 60-66 & Bevan, 1992: 3-26). These differences give rise to some confusion about the methods of ADR and various authors are of the opinion that conciliation and mediation are very similar methods and that the terms are sometimes interchangeable and are normally used synonymously in most discussions (Brown & Marriott, 1993: 19; Boulle & Rycroft, 1997: 62; Business Law, 2000: 247).

English and Roman Dutch law forms the foundation of law within the South African construction industry; however the 1950 Arbitration Act as well as construction industry contracts are based on English prototypes (Butler & Finsen, 1993: 4-11).

In the South African construction industry, mediation is a process whereby the mediator is expected to recommend a non-binding solution if the mediator fails to guide the parties to an agreed solution. However, this is at the discretion of the parties. Where the mediator is not expected to make a recommendation, such mediator is referred to as a conciliator (Butler & Finsen, 1993: 10-11; Bevan, 1992: 15 & Pretorius, 1993: 4).

According to the Principal Building Agreement 1991 and the General Conditions of Contract for Works of Civil Engineering Construction (1990) (cited in Finsen, 2005: 232) the mediator may be required to offer his opinion on the dispute however; the opinion is binding if it is not rejected by the parties within a stipulated time.

The JBCC Principal Building Agreement 2005 edition 5.0 has no mention of the mediator expressing his own opinion and it is submitted that he not be too hasty to offer his opinion of a possible solution. Having a certain respect for the mediator's authority and expert knowledge, parties may well request his opinion for a solution to settlement (Finsen, 2005: 232).

Published guidelines for mediation by the Association of Arbitrators and the South African Institution of Civil Engineers deliberately avoid any set fixed rules of procedure. One of the advantages of mediation is that the procedure should be elastic (Finsen, 2005: 232).

The JBCC Principal Building Agreement 2007 edition 5.0 makes provision for the effective management of disputes by including appropriate methods of dispute resolution in Clause 40 of the document.

3.1 Arbitration

Arbitration defined is an adversarial process supported by law in terms of the Arbitration Act 42 of 1965 whereby disputing parties refer a dispute to an impartial and neutral third party for a final and binding decision regarding issues of the dispute which have been submitted to him (Moore, 1986:7; Business Law, 2000: 248; Butler & Finsen, 1993: 1).

In the past an arbitration clause was generally incorporated into a building contract and in the absence of this, a dispute would be referred to a court of law (McKenzie & McKenzie, 2009: 3).

The arbitration method was the first form of ADR and it was once considered an alternate and preferred method of dispute resolution to litigation because it offered more privacy and procedural flexibility however like litigation; it is still based on court procedure and is of an adversarial nature (Finsen, 2005: 216-217).

3.2 Adjudication

In South Africa adjudication is adopted by the contracting parties according to the agreement they have concluded (Finsen 2005: 223).

Clause 40.6 of the JBCC, (2007:31) provides for the entitlement of parties to submit a dispute to mediation. Unlike the British method of adjudication where a binding decision is made; the decision in the South African construction industry is not final and binding and may be submitted to arbitration or mediation at the discretion of the parties (Finsen, 2005: 223; Brown & Marriott, 1993: 19).

Adjudication has been incorporated into the construction industry building contracts as a method of ADR and although it is of an adversarial nature; the aim is to achieve a speedy resolution to a dispute on a consensual basis (Bevan, 1992:11).

The adjudicator acts as an expert; he/she receives the information on the dispute which is submitted by the parties and makes a decision (Joint Building Contracts Committee (JBCC) 2005 4.1 Adjudication rules, 6.3.1).

Parties are entitled to choose the course of dispute resolution at their own discretion.

3.3 Negotiation

Negotiation is a primary method of ADR however, if it is reduced into constituent elements it may be regarded a skill required for all methods of ADR (Anstey, 1993:12).

Negotiation between the disputing parties may be referred to as unassisted negotiations whereas mediation is a form of assisted negotiation (Boulle & Rycroft 1997: 60-61).

Assisted negotiations may be preferable over unassisted negotiations in so far as supervision by an expert may improve the prospects of satisfactory end result outcomes. Facilitated negotiations are important in the dispute resolution process and parties need to understand the art of effective negotiations.

Practicing professionals should encourage the option of facilitated negotiation in order to inform the parties of the correct procedures so that they may better understand the dispute failing which, they may enter into negotiations based on uninformed principles (Tiruneh, Verster & Kotze, 2007, 5).

3.4 Conciliation

The effective application of conciliation is imperative in the dispute resolution process as this procedure minimizes unnecessary conflict and builds a positive relationship between disputing parties.

Conciliation is viewed as the psychological component of mediation, where the neutral third party will attempt to create an atmosphere of trust and cooperation which encourages constructive negotiation (Moore, 1986: 4, 124).

Conciliation is not only a primary method of mediation, but may be regarded a critical element of the mediation process in order to prepare the parties emotionally and psychologically to continue with the evaluative element in the mediation process however; the method of conciliation may also be applied as a method on its own.

Conciliation is supported by the Four Cs, without which the required standards would not be met and considered appropriate to the ADR context (Loots, 1991: 8-13).

In view of the above, conciliation plays an important role in the ADR process, as it is the method of ADR which is used to resolve differences between parties before they develop into a dispute. It also serves as a primary element of the mediation method; improving interaction between the parties and preparing them psychologically for evaluative facilitation.

3.5 Mediation

Mediation in the South African Construction Industry refers to a facilitated negotiation process in which a non-binding opinion is given by the mediator (Finsen, 2005: 220).

As with conciliation, mediation is an extension and elaboration of the negotiation process facilitated by an impartial and neutral third party selected by the disputing parties (Moore, 1986: 6).

Mediation requires an evaluative approach which is acquired through good knowledge of the subject and experience however; young professionals who have not yet acquired the required technical knowledge to facilitate evaluative mediation but have a good knowledge and understanding of the application and facilitation of conciliation, may still be involved in the resolution of disputes by facilitating the settling of a difference before it develops into a dispute.

4. SKILLS AND TECHNIQUES

Mediators require a range of skills and techniques in order to execute the functions applied by mediators. These skills are inherent, learned, and intuitive; or may be acquired and developed through education, training and experience. Each mediation skill supports a function and can contribute to more than one function. Mediation skills can be inherent however, these skills can also be learned, practiced and developed and can be measured and assessed and applied with a certain degree of objectivity (Boulle & Rycroft, 1997:139-140; Brown & Marriott, 1993: 251).

4.1 Communication

“The most important thing in communication is to hear what isn’t being said” (Drucker, 2008: online).

Moore (1986: 143) suggests that communication is central to the negotiation process.

Conflict results from poor communication, and will invariably inhibit the ADR negotiation process (Van Zyl, Verster & Ramabodu(2010: 6).

The science and art of communication play an important role in the ADR process as good communication skills support constructive negotiations.

Poor communication skills create a negative cycle in which disputes are difficult to resolve (Van Zyl et al., (2010: 6).

Unproductive communication may lead to a breakdown in communication whereas productive communication adds value to the negotiation process.

Povey (2005: 2) indicates that mediators in the industry rely on their communication skills to facilitate the mediation process.

Contrary to the above, Moore (1986: 143) suggests that the extent, form and quality of communication contribute to the successful outcomes of negotiation.

4.2 Negotiation

ADR facilitators need a sound theoretical and practical knowledge of negotiation skills which is fundamental to all consensual ADR activity (Brown & Marriott, 1993: 88; Anstey, 1993: 12). Due to the lack of negotiation skills education, relatively little is known of the science and art of the subject (Anstey, 1993:12).

In support of the above, Brown & Marriott (1993: 88) suggest that learning negotiation skills will improve on any existing inherent skills.

Negotiation is a skill that should be applied in all methods of ADR.

5. ATTRIBUTES

The inherent attributes may enhance the effectiveness of mediation skills to create more satisfactory end results. The psychological element of mediation should not be disregarded as it is the process of building trust between parties, creating a peaceful atmosphere which contributes to positive negotiations (Moore, 1986:124).

5.1 Listening

Trollip (1991: 47) suggests it is the act of repeatedly hearing and listening!

Effective listening is also vital to the communication process and addresses the following important factors:

- Allows the parties to speak without interruptions
- Develops a better understanding of the concerns based on both the verbal and non-verbal message.
- Helps to understand and summarise concerns
- Creates a situation where the mediator can absorb the message and integrate it into an extension of the negotiation process. (Boulle & Rycroft 1997: 153 – 154).

By listening effectively the mediator is able to better understand the concerns and needs of the parties and guide them toward consensual settlement.

5.2 Empathy

Empathy refers to comprehension the professional has on the thoughts, perceptions and feelings of the parties and responding to them in a sympathetic way (Boulle & Rycroft, 1997: 78-79).

Some professionals may have become so business focused that they find it difficult to relate with empathy. In view of the above, it is suggested that the mediator acknowledge and validate understanding and appreciation for the feelings and ideas of all parties to the dispute.

Through experience, the practicing professional may develop a good understanding of the more general types of disputes which occur in a project and therefore naturally have empathy when relating to these.

6. CONTRACT LAW

The JBCC Dispute Settlement Clause 40, 2007 edition 5.0 provides for variation in the application of dispute resolution in the Construction industry. Furthermore, the General Conditions of Contract (2004) Clause 58 also supports this stance (cited in McKenzie & McKenzie, 2009: 351-352).

7. RESEARCH METHODOLOGY

A literature review was conducted to determine the requirements of professionals facilitating ADR in the South African construction industry.

The Departments of Quantity Surveying of three universities in South Africa were approached to discuss their syllabi upon which, the tertiary levels were determined.

Based on the findings of the literature review, a questionnaire survey was conducted on practicing Quantity Surveyors to determine the knowledge and awareness levels of the ADR requirements of professionals in the industry, how they rate the importance of these requirements and what experience they have achieved in this regard. Thirty questionnaires were distributed with a 76% response. The 23 respondents were divided into under 30 years, 30 -40 years and over 40years age groups, after which the results were analysed.

The respondents were divided into age groups to compare recent entrants to the industry to the more experienced practitioners.

Respondents were required to rate their importance, awareness/knowledge and experience levels on the following ADR elements:

- The Four Cs as discussed in paragraph 2,
- ADR methods as discussed in paragraph 3,
- Facilitation skills and techniques as discussed in paragraph 4,
- Attributes as discussed in paragraph 5 and
- The JBCC Dispute Clause 40 as discussed in paragraph 6.

The importance and awareness/knowledge ratings will reflect the education and training levels in as much as, if the importance rating is high with a lower knowledge rating, this may imply that the particular element in the syllabi may need to be reviewed.

Experience level ratings were requested because if ADR was not addressed in the initial education and training professionals encountered, experience combined with knowledge develops competence which relates to knowledge.

8. FINDINGS

The responding tertiary institutions include all the ADR elements in their syllabi however; attributes and facilitation skills and techniques are only addressed superficially.

Young professionals in the industry rate the importance of the requirements for ADR as high although their knowledge ratings are slightly lower however; the experience levels are somewhat lower. The lower experience levels are self explanatory as these young professionals are recent entrants to the industry.

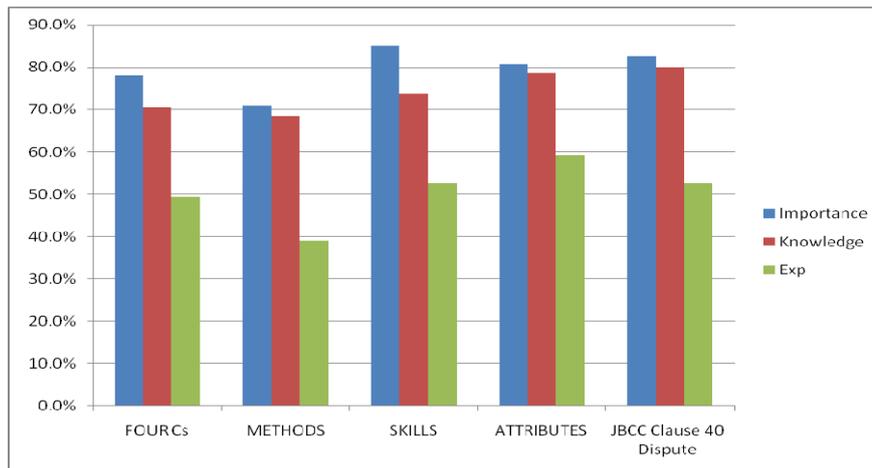


Figure 1: Importance, knowledge and experience ratings for under 30 year age group

The 30-40 year age group have slightly lower ratings for both importance and knowledge than the under 30 year age group with slightly higher experience levels. The experience ratings can be expected to be slightly higher than that of the under 30 year age group.

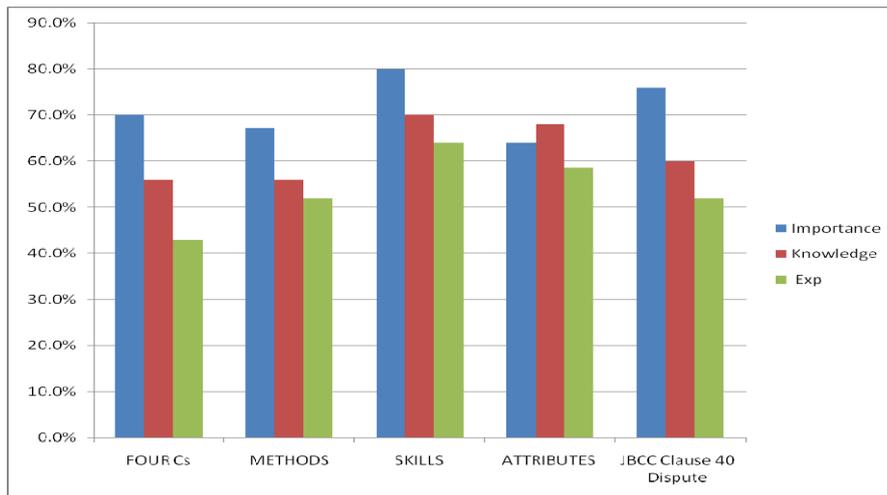


Figure 2: Importance, knowledge and experience ratings for 30 -40 years age group

The over 40 year age group have high importance, knowledge and experience ratings. Although ADR was not as prominent at the time of these professionals' initial education and training, experience gained develops knowledge and the importance of ADR is realised.

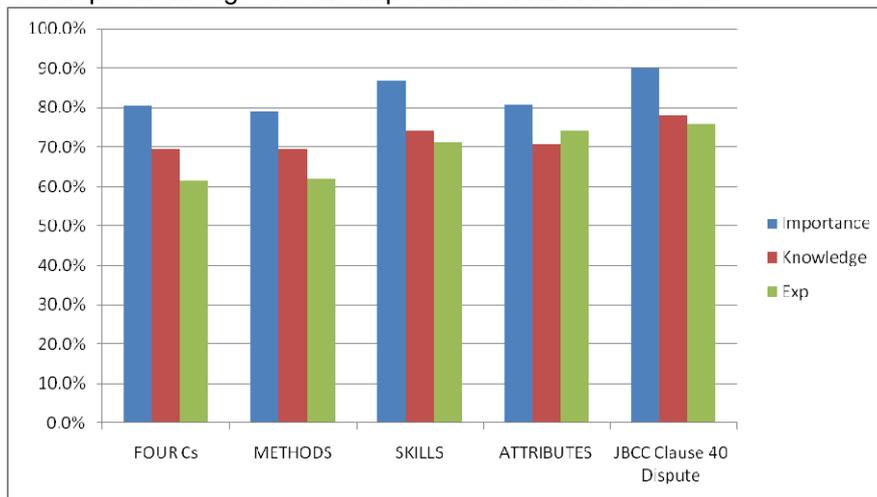


Figure 3: Importance, knowledge and experience ratings for over 40 years age group

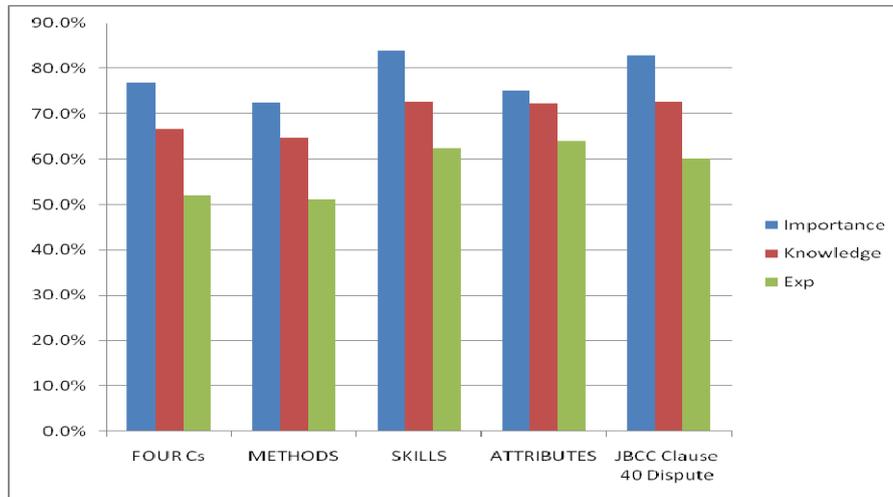


Figure 4: Average importance, knowledge and experience ratings for all respondents

Apart from the attributes, the variance between importance, knowledge and experience ratings have remained constant throughout the analysis. Professionals in the South African construction industry have an above average knowledge of the ADR concepts

In support of Povey's research which indicates that professionals rely on their communication skills for effective facilitation, communication and negotiation skills have high ratings in this study. This result contradicts the literature review suggestion by Anstey (1993) that there is a lack of negotiation skills education however the communication and negotiation skills may be inherent and learned through experience.

9. CONCLUSION

The higher ratings found in the analysis of the under 30 years age group indicates that education and training needs are being addressed in the syllabi of tertiary education however, the variance between the importance and knowledge ratings may imply that the depth of the subject may need to be reviewed.

The lower ratings in the 30-40 age group may be due to the fact that ADR was not as prominent at the time these professionals received their initial education and training. More emphasis has been placed on the Four Cs in the past decade (Loots, 1991), thus explaining the lower experience ratings.

The variance of the over 40 Knowledge and importance ratings may not be as great due to the fact that knowledge combined with experience develops competence, which translates to knowledge.

Although the knowledge component of ADR is addressed in the syllabi, the depth of the training may be questionable, thus creating an awareness of the importance without necessarily fully understanding the subject matter.

10. RECOMMENDATIONS

It is recommended that tertiary institutions strengthen their syllabi in terms of attributes, skills and techniques placing emphasis on negotiation and communication skills to enhance negotiation skills which is an important element in all methods of ADR.

Institutions may consider distributing informative brochures on ADR developments.

Opportunities may be provided by institutions in the form of development courses for more experienced professionals to update their knowledge of ADR as a method of Continuous Professional Development.

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Culture Change in Construction: A Novel Approach for Achieving Lean Principles Objectives in Construction Projects

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ABSTRACT

Purpose of this paper: Unlike other industries that have greatly improved their performance and level of quality through applying lean production principles, the majority of design and construction firms are reluctant to change their culture towards accomplishing lean construction objectives. This paper aims to investigate the role of culture change as an innovative approach for achieving lean principles objectives in construction projects.

Methodology: To achieve this aim, a research methodology is designed to achieve four objectives. Firstly, literature review is used to understand the fundamentals of lean production and organisational culture change. Secondly, global case studies of successful firms benefited from culture change in improving their performance are collected and analysed qualitatively. Thirdly, developing an innovation framework to build lean culture in design and construction firms as an approach for achieving Lean principles objectives in construction projects. Finally, summarising research conclusions and recommendations for decision makers and construction professionals.

Findings: Changing organisational culture is essential for successful achievement of Lean principles objectives in construction projects. Obstacles of culture change in design and construction firms have to be overcome through well planned and managed change programmes.

Research implications: This research promotes planned culture change in design and construction firms to facilitate the achievement of lean principles objectives which ultimately improve the performance of construction industry at organisational and project levels.

Practical implications: The adoption of the lean culture framework developed by this research will facilitate building lean culture in design and construction firms which ultimately achieve Lean principles objectives in construction projects.

Value: This research adds valuable contribution the original body of knowledge through identifying the obstacles of successful implementation of lean principles in construction. The research developed an innovative framework aimed to build lean culture in design and construction firms as a novel approach towards achieving lean principles objectives in construction projects, which eventually improve the performance of the construction industry.

Keywords: Culture Change, Lean Production, Lean Culture, Design and Construction Firms, People, Construction Projects.

1 INTRODUCTION

For decades, the construction industry is known for its chronic problems of fragmentation, low productivity, time and cost over-runs, poor safety, inferior working conditions and insufficient quality. A number of visions, strategies, methodologies and action plans have been developed to alleviate these problems. They included for instance: industrialization, computer integrated construction, constructability, partnership, robotized and automated construction. In spite of these solutions, the performance of the construction industry is considered low if compared to other industries (Latham, 1994; Koskela, 1992& 1997; Egan, 1998; Othman, 2010). Great improvements in performance have been observed in manufacturing, especially lean automobile industry which uses half of manufacturing space, half of human effort in the factory, half of product development time and half of investments in tools (Koskela, 2004). These improvements were the result of the development and implementation of a new production philosophy called "Lean Production". The primary goal of the new philosophy is to avoid waste of time, money, equipment, etc. and improving value through employing and combining existing partial approaches such as Just in Time (JIT), Total Quality Management (TQM), time-based competition and concurrent engineering (Melles and Wamelink, 1993). Adopting the "Lean Production" philosophy is expected to bring a revolutionary change to the way of work in every industry. As a result, in construction, lean production has been adopted relatively quickly by contracting companies which are keen to reduce waste in their construction projects. Even if only a small fraction of the gains observed in manufacturing were realised in construction, the incentive to apply these concepts would be tremendous (Emmitt et al., 2004). In contrast, most companies that get on applying lean principles rapidly become frustrated with kaizen events and isolated improvement projects which produced great short-term results but have no sustainability. These companies are searching for something more which is the culture of continuous improvement with its philosophy, processes, and people aligned to cultivate problem solving. No doubt, changing the culture, values, beliefs and attitudes of employees are a difficult task. What might be considered a lean operation one day could slide back into the old ways of doing things overnight. It becomes apparent that the only way to build a lean culture is to change the culture of workplace and get buy in from every employee at all levels of the organisation. Without developing a lean culture, a company will not get all the traction it needs to reach the full potential of lean

(Velaction, 2010). This paper aims to investigate the role of culture change in design and construction firms as a novel approach for successful achievement of lean principles objectives in construction projects. A research methodology is designed to achieve this aim. Firstly, literature review is used to build a comprehensive background about lean production philosophy and principles, organisational culture change, lean culture components, skills and behaviours required to build and manage a lean culture, developing and maintaining committed leaders and team members who sustain and improve lean culture. Secondly, global case studies of successful firms benefited from culture change in improving their performance are collected and analysed qualitatively. Thirdly, an innovative framework to facilitate the integration and application of lean culture in design and construction firms is developed. Finally, research conclusions and recommendations for decision makers and construction professionals are outlined.

2 LEAN PRODUCTION

2.1 Background and Concept Development

For many, Lean is the set of "tools" that assist in the identification and steady elimination of waste. As waste is eliminated quality improves while production time and cost are reduced. In fact, lean production does not include really new principles of management techniques. It only combines existing principles in a new day. The primary goal of lean production is to avoid waste of time, inventory, space, labour, equipment and money. What has become known as "Lean Production" is largely derivated from the Toyota Production System (TPS) which aimed to produce value, as defined by the customer, without producing waste. At Toyota, TPS is only part of a broader business philosophy known as the Toyota Way. Originally, the Toyota family owned a loom manufacturing business. Their initial innovation was to power the looms with a steam engine and then provided a system that would automatically shut down the loom when the thread broke. This helped eliminate the waste that would occur if the loom continued to run and produced defective material. This principle of automation was the first one of the two pillars of TPS. Building on the financial success of the loom business, Toyota Motor Company was launched in the late 1920's. In 1950, Toyota's chairman visited the United States and saw that Toyota's productivity was lagging desperately behind Ford and GM. Upon his return to Japan, he challenged Taiichi Ohno, Toyota's plant engineer, to meet the U.S. level of productivity within three years; this effort would require a ten-time improvement in productivity. In spite of the challenges that faced Toyota of capital availability, supply chain, or infrastructure to support that level of productivity and low demand of cars in Japan, the second pillar of TPS developed JIT delivery where items would be put into production when there was an order. JIT helped Toyota to minimize inventories of finished goods and avoid storing raw materials (Melles and Wamelink, 1993; Tapping, 2002). Later on, Toyota has identified seven types of waste that have to be eliminated, see table (1).

Table (1) Toyota's 7 Types of Waste (Kotelnikov, 2001)

1	Overproduction	Producing items for which there is no order resulting in overstaffing, storage or transportation
2	Waiting	Workers idled watching a machine or waiting for material, equipment, approvals or directions
3	Unnecessary Transport	Moving work-in-process or inventory
4	Over or incorrect processing	Taking unneeded steps to achieve an outcome, inefficiencies due to poor tools or design; procuring to higher standard than required
5	Excess Inventory	Raw material, WIP or finished goods, increasing lead time, obsolescence, damaged goods, storage, transportation; also hides production and delivery problems
6	Unnecessary movement	Wasted employee motion – looking for, reaching for, stacking parts or tools. Walking is waste
7	Defects	Production of defective parts or correction. Repair, rework, Scrap and inspection

TPS is only part of the "Toyota Way" – the business philosophy that provides the context for TPS. Liker (2003) identified the following 14 principles of what he calls "The Toyota Way":

Table (2) Toyota's Way Principles (Liker, 2003)

1	Base management on a long-term philosophy, even at the expense of short-term financial goals
2	Create continuous process flow to bring problems to the surface
3	Use "pull" systems to avoid overproduction
4	Level out the workload
5	Build a culture of stopping to fix problems, to get quality right the first time
6	Standardized tasks are the foundation for continuous improvement and employee empowerment
7	Use visual control so no problems are hidden
8	Use only reliable, thoroughly tested technology that serves employees and process
9	Grow leaders who thoroughly understand the work, live the philosophy, and teach it to others

10	Develop exceptional people and teams who follow company's Philosophy
11	Respect extended network of partners and suppliers by challenging them and helping them improve
12	Go see for yourself to thoroughly understand the situation
13	Make decisions slowly by consensus, thoroughly considering all options; implement decisions rapidly
14	Become a learning organisation through relentless reflection and continuous improvement

The increasing awareness of eliminating waste and adding value energized the development of other approaches such as TQM, time based competition, value based management, process redesign, world class manufacturing and concurrent engineering. Analysis showed that these management approaches has a common core, but view this from more or less different angles. The new production philosophy is emerging through generalization of these partial approaches (Schonberger 1990; Plossl 1991). The new production philosophy has already had a profound impact in such industries as car manufacturing and electronics. The application of the approach has also diffused to fields like customized production, services, administration, product development and construction (Koskela, 1997).

2.2 Benefits and Methods of Lean Production

The application of a lean production system would allow companies to achieve the following benefits:

- Reducing waste by 80% and production cost by 50%.
- Decreasing manufacturing cycle times by 50%.
- Reducing labour by 50% while maintaining or increasing throughput.
- Reducing inventory by 80% while increasing customer service levels.
- Increasing capacity in current facilities by 50%.
- Improving quality and increasing profits.
- Increasing system flexibility in reacting to changes in requirements.
- Creating better strategic focus.
- Improving cash flow through increasing shipping and billing frequencies.

The most important methods used to attain lean production are: JIT, TQM, time based competition, concurrent engineering, process redesign (or reengineering), value based management, visual management, total productive maintenance and employee involvement (Kotelnikov, 2001).

3 APPLICATION OF LEAN PRINCIPLES IN CONSTRUCTION

Lean construction is the continuous process of eliminating waste, meeting or exceeding all customer requirements, focusing on the entire value stream and pursuing perfection in the execution of construction project. This definition includes many fundamental aspects of a lean philosophy. It is a philosophy that requires a continuous improvement effort that is focused on a value stream in terms of the needs of the customer and improvement through eliminating waste in the process (Construction Industry Institute, 2011). Towards creating lean workplace, a set of lean principles and best practices could be applied in construction including:

- Customer focus
- Culture/people
- Workplace standardisation
- Waste elimination
- Continuous improvement / built-in-quality

Although the lean concepts have been brought to the construction industry in a number of countries including, Australia, Brazil, Denmark, Ecuador, Finland, Peru, UK, USA and Venezuela (Ballard and Howell, 2003), surveys in the UK carried out by Common et al. (2000) concluded that the construction industry in general has been slow in taking lean concepts. Becoming lean involves the entire company, and it doesn't happen overnight. Lean cannot be reduced to a set of rules or tools. It must be approached as a system of thinking and behaviour that is shared throughout the value stream. It needs a comprehensive commitment to long term improvements (Hunting, 2010). It amounts to a cultural change for the company. Due its nature, construction is not a simple deterministic system. Lean principles must be understood and applied in a context and require a comprehensive understanding of a complex, interacting and uncertain construction system (Construction Industry Institute, 2011). Kenny and florida (1993) stated that although lean production paradigm has much to offer, the success of its implementation depends upon the organisational environment and culture within which is developed. Lean thinking recognises that people are a key factor for improving processes and the way they view their work is important. Successful development of lean construction requires strategies and methodologies based upon social constructivism (Garnett, 1999).

4 Lean Culture and Organisational Change

Culture is the set of shared values, beliefs, behaviours, goals, attitudes, practices that characterizes an institution, organisation, society or group (Wikipedia, 2011). From a business point of view, culture is the sum of peoples' habits related to how they get their work done. People talk about their company's culture all the time as a reason why they can or cannot do something. Organisation's culture is enabling or inhibiting change or resistance. Annual reports proudly refer to company culture as an invaluable asset (Mann, 2005). Lean construction cannot be accomplished without getting the people ready to apply lean philosophy through building lean culture. There are different types of organisational changes including: strategic change, structural change, process-oriented change and people-

centred change. The later is focused on culture change in organisations. People-centred change aims to change the attitudes, behaviours, skills, or performance of employees. Changing people-centred processes involves communicating, motivating, leading, and interacting within groups. This focus may entail changing how problems are identified and solved, the way employees learn new skills, and how employees perceive themselves, their jobs and the organisation. Some people-centred changes may involve only incremental changes or small improvements in a process. For example, many organisations undergo leadership training that teaches managers how to communicate more openly with employees. Other programs may concentrate on team processes by teaching both managers and employees to work together more effectively to solve problems (Benowitz, 2001). Towards achieving lean principles objectives in design and construction firms, people culture has to be changed and focused towards perceiving and applying lean production concepts. Without such improvement and changes, design and construction teams will continue doing the work the old way or they may pretend applying lean principles which is unsustainable.

5 Leadership, Team Building and Lean Culture

Leadership is a social influence process in which the leader seeks the voluntary participation of subordinates in an effort to reach organisational objectives (Kreitner and Kinicki, 1992). Newstrom and Keith (1993) defined leadership as the ability to persuade others to seek defined objectives enthusiastically. It is the human factor that binds a group together and motivates it toward goals. It is the ultimate act that brings to success all the potential that is in an organisation and its people.

Towards coping with the rapid changes in the business environment in terms of policy, economy, law, technology, and competition and as an approach to exploit the positive effects of these changes and avoid their threats to the organisation's future, many organisations including design firms changed their policies, strategies, structures and methods of performing works. Team work has become the cornerstone of any organisation wishes to remain in market and compete for the future (Gibson et al., 2003; Othman, 2008). It became apparent that changing people's culture to work in teams is a fundamental approach that leaders play towards achieving clients' objectives, accomplishing their satisfaction, facilitating coping with rapid changes in the work environment, and significantly improving the product quality (Wellins et al., 1994; Dorio, 1994). Being described as a group of people with a high degree of interdependence geared towards the achievement of a goal or completion of a task, team members agree on a goal and agree that the only way to achieve this goal is to work together (Parker, 1990). Team building is a catchall term for a whole host of techniques aimed at improving the internal functioning of work groups, whether conducted by company trainers or outside consultants (Kreitner and Kinicki, 1992). Training, motivating and resolving conflicts between team members are important elements of team building (Association of Project Management, 1993). Encouraging team members to work and plan together results in their commitment to achieve the agreed goals. The sense of being a part of a team encourages people to develop their talents, contribute their ideas and pass the sense of

teamwork to others in their organisations (Macadam, 1996). With the presence of an effective organisational leadership, design and construction firms can create a lean culture through utilising the power of team work to change the way of doing work, perceive, adopt and apply the lean production principles in construction projects. Training design and construction team leaders to educate, lead and direct design and construction teams and motivating them to deliver lean projects is a paramount to achieve lean construction objectives. The role of leaders within the organisation is a fundamental element of sustaining the application of lean principles. One of the obstacles of achieving the objectives of lean construction is that organisations focus on the tools and methodologies of lean rather than the philosophy and culture of lean. Empowering employees through engaging them in long-term relationship based on continuous improvement and team work as well as mutual trust are considered one of the pillars of core management principles towards continuous improvement where the other pillar is elimination of waste (Mann, 2005; Schabracq, 2005; Othman, 2008).

6 CASE STUDIES OF ORGANISATIONS BENEFITED FROM CULTURE CHANGE IN IMPROVING THEIR PERFORMANCE

The following are five online case studies collected purposely to show how changing organisational culture and adopting lean principles can help organisations improve their performance and achieve their goals. These cases, which took place in UK and USA, covers organisational re-structure, leadership development, increasing annual turnover and reducing waste of time and cost. Three of these cases are business and banking oriented where the others are construction oriented. Learning from other industries is beneficial and helps improve the construction industry.

6.1 Case Study (1): Communicating organisational change in a high street retailer

An organisational re-structure necessitated that two teams consist of 2500 employees represent the call centre and frontline sales staff, have to be joined together in one organisation. This called for the creation of lean culture and team ethos to:

- Inspire and encourage team leaders and employees to embrace and co-operate with each others.
- Create a deep understanding and ownership of their roles and responsibilities towards achieving business objectives.
- Improve communication between team members and management team.

Towards building lean culture, a training session is delivered to 4 groups of 50 team Leaders. It included:

- Communicating the vision of the new organisation.
- Analysing the performance of team leaders and their teams against the stated vision.
- Identifying the organisational and individual barriers that inhibit

- achieving the business vision, and putting the solutions to overcome these obstacles.
- Creating a powerful experience and personal commitment as well as team spirit amongst all team leaders.
- Introducing the management tools available to assist team leaders to face the challenges of leading their teams and communicating the business vision.
- Developing an action plan to be implemented after the return of team leaders to their workplace.

Subsequently, the 200 leaders communicated the messages with enthusiasm and commitment to their teams to achieve. To measure the achievement of the business vision, it was linked to their performance plans, which also incorporated using the management tools, and measured the success through learned lessons and feedback gained from employees (Pinpoint Management Training, 2010).

6.2 Case Study (2): Leadership Development in an International Bank

Because of an organisational re-structure, a number of leadership initiatives have been developed and delivered to the senior management to raise business performance through reducing staff turnover and increasing high performing teams. After 6 months, these initiatives were reported as not producing the expected business results. Hence, a consultant was introduced to evaluate and provide suggestions and feedback to make these initiatives more successful. The consultant reviewed the content of the designed initiatives and conducted survey questionnaires with all leaders. Analysis of collected data showed that:

- The developed initiatives were focused on detailed information, based on theory and lacked relevance to their roles.
- There was no opportunity to practice skills and employees were unsure of what to implement and the way forward.

Then, the consultant established the development needs through involving and consulting with the individual leaders. An approval for the developed needs have been gained from the executive sponsors. A number of objectives have been devised to fulfil the development needs, they included:

- Understanding the available tools, how and when they will be used.
- Providing an opportunity to practise these tools in a safe environment.
- Establishing effective ways for implementation.
- Committing to an action plan that transferred the needs and plans to the workplace.

As a result, individuals felt that they had a better and clear understanding of what was expected from them and how to support each other. Regular following up meetings were conducted to review their progress and maintained the focus of the initiatives. In addition, the tools were understood and used effectively, which enabled decreasing staff turnover, and ultimately resulted in increasing business performance (Pinpoint Management Training, 2010).

6.3 Case Study (3): Developing Leadership in a Large Corporate Sales Team

Towards mitigating the consequences of a backdrop of organisational change, a training consultant was approached to look at leadership development for the senior management team. Although well established, the team wanted to develop a stronger leadership culture to ensure that the organisational change programme was successful and new stretching targets were achieved. The consultant discovered a comfortable environment where leaders operated individually with very little formal or informal feedback process. There was a general sense that everyone needed to be more honest when talking about performance, particularly with under performers within their teams. As an action, a number of objectives have been developed and agreed by team members. They included:

- Establishing strong support and challenge principles within the team.
- Establishing the principles and benefits of giving quality feedback.
- Giving an opportunity to practise giving and receiving quality feedback.
- Understanding how we react to change and how to deal with this.

These objectives were delivered to 3 groups of 12. As a result and because of its effectiveness, these sessions were subsequently cascaded to the next management level driving the change through the organisation. Furthermore, this was followed with 1:1 coaching and feedback sessions with a number of key people within the senior leadership team. This has become second nature, increasing performance levels, which sequentially has significantly raised the sales productivity within the area (Pinpoint Management Training, 2010).

6.4 Case Study (4): Lean Principles for Increasing Annual Turnover

Pacific Contracting of San Francisco, a specialist cladding and roofing contractor, have used the principles of lean thinking to increase their annual turnover by 20% in 18 months with the same number of staff. The key to this success was improvement of the design and procurement processes in order to facilitate construction on site, investing in the front end of projects to reduce costs and construction times. They identified two major problems to achieving flow in the whole construction process, namely: inefficient supply of materials which prevented site operations from

flowing smoothly, and poor design information from the prime contractor, which frequently resulted in a large amount of redesign work. To tackle these problems Pacific Contracting combined more efficient use of technology with tools for improving planning of construction processes. They use a computerized 3D design system to provide a better, faster method of redesign that leads to better construction information. Their design system provides a range of benefits, including isometric drawings of components and interfaces, fit co-ordination, planning of construction methods, motivation of work crews through visualization, first run tests of construction sequences and virtual walk troughs of the product. They also use a process-planning tool known as Last Planner to improve the flow of work on site through reducing constraints such as lack of materials or labour (Construction Excellence, 2004).

6.5 Case Study (5): Lean Principles for Reducing Waste of Project's Time and Cost

The Neenan Company, a design and build firm is one of the most successful and fastest growing construction companies in Colorado. The firm has worked to understand the principles of lean thinking and look for applications to its business, using 'Study Action Teams' of employees to rethink the way they work. Neenan's have reduced project time and cost by up to 30%, through developments such as:

- Improving the flow of work on site by defining units of production and using tools such as visual control of processes.
- Using dedicated design teams working exclusively on one design from beginning to end and developing a tool known as 'Schematic Design in a Day' to dramatically speed up the design process.
- Innovating in design and assembly, for example through the use of pre-fabricated brick infill panels manufactured off site and pre-assembled atrium roofs lifted into place.
- Supporting sub-contractors in developing tools for improving processes (Construction Excellence, 2004).

7 DISCUSSION

Literature review and case studies showed that creating organisational lean culture through changing people's values, attitudes and behaviours is a cornerstone for achieving lean principles objectives in construction projects. Organisations are concerned with lean tools and techniques, where the most important asset (employees) who use these tools and apply these techniques, do not receive enough training or motivation to embrace and apply lean concepts. This necessitated the importance of developing a lean culture framework to facilitate the adoption and application of lean principles in design and construction firms through culture change. In addition, the support and understanding of senior management helps, greatly to achieve development objectives. Furthermore, the assistance of external training and development institutions could be helpful if the organisation does not have sufficient

experience to improve its performance, face its challenges or ultimately seeking new ideas.

8 THE LEAN CULTURE FRAMEWORK

8.1 Definition and Importance

Framework is defined as a broad overview, outline, or skeleton of interlinked activities which supports a particular approach to achieve a specific objective, and serves as a guide that can be modified as required by adding or deleting items (Business Directory, 2011). The Lean Culture Framework (LCF) (hereinafter referred to as "the framework" or the "LCF") describes the functions and activities that need to be undertaken as well as the tools and techniques required, to effectively create lean culture in design and construction firms towards achieving lean principles objectives in construction projects. The need for this framework stems from the necessity to improve the performance of the construction industry through achieving the objectives of lean principles in terms of generating values, reducing cost, meeting customer needs, reducing waste and continues improvement.

8.2 Description of the Framework

The framework consists of four activities: (1) Establishing culture vision, mission, objectives & strategies, (2) allocating resources & getting senior management support, (3) implementing developed plans, (4) evaluating & feedback, see figure (1).



Figure (1) Lean Culture Framework

(a) Establishing culture vision, mission, objectives & strategies

This activity represents a fundamental aspect of this framework as it

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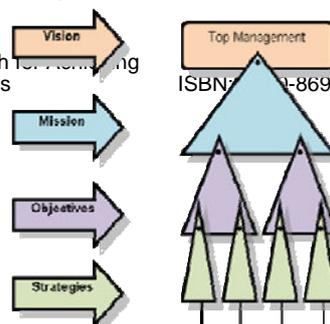


Figure (2) Cascade Approach

considers building lean culture as a strategic element towards achieving lean principles objectives. Hence, it has to be planted in the organisation overall vision. This is the responsibility of top management of the organisation. It should be a short, succinct, and inspiring statement of what the organisation's culture should be in the future. It describes aspirations for the future, without specifying the means that will be used to achieve those desired ends. After the lean culture vision has been established, it needs to be put in a practical way to be achieved. This will be accomplished through breaking down or transferring the organisation's vision into a mission, then objectives and finally strategies. This could be done through using the Cascade approach to strategies setting, see figure (2). Establishing vision, mission, objectives and strategies provides direction and guidance to the employees, measuring objectives achievement and setting time line and designates duties of all personnel.

(b) Allocating resources & getting senior management support

This is the second activity of this framework. It is of prime importance after the establishment of vision, mission, objectives and strategies to allocate the resources needed for implementation. Conducting a kick off meeting is essential to set the rules, establish the grounds, state the norms, values and way of work. Within this meeting every employee is assigned a task, needed resources are provided and timeframe is established. Getting management support and approvals is necessary to facilitate securing the required resources, apply the lean principles at the different stages of the design and construction process, and enforce corrective actions when needed.

(c) Implementing developed plans

Within this activity, the assigned tasks and developed plans in the previous step will be executed. The implementation plans may require that employees involved in the lean process be trained and equipped with all tools and technologies required to guarantee the successful execution of plans. In addition, team work and senior management support and offering required facilities will help developing lean culture and achieving lean construction objectives. To ensure the quality of work performed, the implementation activity should use the work authorization system, which verifies predecessor activities and permits the successor activity to begin.

(c) Evaluating & feedback

The aim of this activity is to evaluate the organisation's performance towards achieving the established vision, mission, and objectives developed at the first activity. It focuses on investigating how the design and construction firms succeeded in building lean culture and to what extent it helped accomplishing lean construction objectives. Errors, misunderstanding and problem occurred as well as corrective actions taken during the implementation activity have to be documented and fed back to senior management to consider when developing new strategies in the future.

8.3 Application of the Framework

The framework establishes the activities and set the rules that help creating lean culture as an approach for achieving lean principles

objectives. But due to limited timeframe of the research, it was not possible to apply and evaluate the framework. Hence the LCF needs to be tested and validated in real construction projects. In addition, the effective application of the LCF depends to a large extent on the willingness and encouragement of the senior management in design and construction firms to adopt the developed framework. In other words, if the senior management does not have the desire and tended not to use the framework, then its adoption will be limited. Since the adoption and application of the framework is a long-term process and due to the tight schedule in construction projects, this framework might not be welcomed by some sectors of the industry.

8.4 Action Plans for facilitating the adoption of the framework

In order to overcome the above mentioned limitations and increase the opportunities of adopting the framework, the following action plans have to be followed:

- ❖ Introducing the concept of lean culture to the construction industry in general and managers and employees of design and construction firms in particular and highlighting the importance of building lean culture as an approach for achieving lean construction objectives. This could be done through publications, workshops, symposiums and conferences carried out by academics and professionals specialized in this area and organized by engineering associations and professional bodies (i.e. Lean Construction Institute) and cost will be shared by participants or by covered by local councils or sponsors.
- ❖ The benefits of the framework should be presented and explained to senior management in order to convince them with the role, which the framework could play in achieving lean construction objectives. This could be done by research and development (R&D) departments at design and construction firms.
- ❖ Sufficient time and resources should be allowed and offered to build lean culture in design and construction firms to facilitate the implementation process.

9 CONCLUSIONS AND RECOMMENDATIONS

Although the construction industry has been considered as one of the biggest industries worldwide, it has been known for its chronic problems of fragmentation, low productivity, time and cost over-runs, poor safety, inferior working conditions, and insufficient quality. Towards overcoming these problems and learning from other industries that made leaps of improvement, a number of initiatives have been developed. Despite the valuable contributions of these initiatives, the performance of the construction industry is considered low if compared to other industries. The growing recognition for lean production worldwide called for the application of lean principles in construction. In spite of the application of lean principles in many organisations, the absence of lean culture in design and construction firms is a constraint that hinders the achievement of lean objectives. This paper highlighted the need for creating lean culture in

design and construction organisations and developed a framework to facilitate the creation of such culture. A number of action plans essential for adopting and successful application of the framework have been developed. This paper recommends creating lean culture in design and construction firms as an approach for gaining the benefits of lean principles. In addition, the paper encourages R&D departments in design and construction firms to test, validate and improve the developed framework to suite their requirements and highlight its benefits and learned lessons to peers in the construction industry.

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ASOCSA2011-52

Improving the quality of life in low income residential neighbourhoods of Ibadan, Nigeria.

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ABSTRACT

Purpose: This study seeks to investigate the quality of life of people in the low income strata in Ibadan and proffer actionable solutions vis-a-vis policy formulation.

Design/Methodology/Approach: A review of literature which is hinged on the framework of habitability model is used as a standard for quality. Closed and open ended questionnaires were administered on residents of identified low income neighbourhoods and analyzed using simple tables.

Findings: It was discovered that so many residents are victims of unfair application of urban renewal policies which gives results opposite of what was initially intended.

Research Limitation & Implication: The survey was carried out on low income neighbourhoods of Ibadan randomly sampling 1000 respondents. Adequate funds and time coupled with sincerity on the part of respondents would have given greater spotlights on the discourse.

Practical Implication: This paper creates awareness for low income dwellers and tenants that they can contribute their quota to policy formulations which in turn affects their well-being

1.0 INTRODUCTION

In terms of meeting housing needs in Ibadan and elsewhere, the largest producers of housing and the main urban developers are the local residents

who have built more than 30 per cent of the country's housing stock.(Agbola, 2007) In securing housing, low-income families have adopted various strategies including owner-occupation, renting and squatting. In recent decades, there have been fewer opportunities for squatting which traditionally is the preferred strategy for accessing housing by the urban poor vis-à-vis the low income group.

There is great variety in the proportion of people in different cities who are tenants (from cities where less than 10 per cent are tenants to cities where more than 80 per cent are tenants). A recent survey of cities during the last population census showed that more than 60 per cent of the population were renters. (NPC, 2006). As land becomes more valuable, illegal land occupation become more difficult and there are few sites for which ownership is not already claimed (whether legally or illegally). Cheap land sites are almost always available in the less commercially attractive areas but in general, in the larger the city, the greater the distance between these cheap sites and the locations where most low-income households secure their livelihoods. As demand for housing increases in areas where many cannot afford to own land, those with land adjust or extend their structures to allow part or all of them to be rented. Renters may face increasing rents with few possibilities for owner-occupation.

In Ibadan, as witnessed in most Nigerian cities, uncontrolled expansion of the city was not foreseen and no plans were made to maintain the basic infrastructure of the city while major problems are simply dealt with after they have occurred.

In this context, this paper looks at how to make urban centres fit to live in while promoting and encouraging alternative and participatory plans to secure decent housing for all. Effective housing policies must learn from and build on the livelihood and housing strategies developed and used by the most deprived sector of the population. In this respect, metropolitan Ibadan offers a significant opportunity arising from the concentration of poor urban citizens who daily demonstrate their creativity by ensuring their own survival and that of Ibadan as a city.

Tenants are often particularly vulnerable to rapid socio-economic and urban change. They generally have little or no effective legal protection and can be displaced from their accommodation by the owners at short notice. Even where contracts exist between tenants and owners, owners often insist on short-term contracts. Tenants are often subjected to sudden increase(s) in rent, especially when landlords are themselves suffering economically and increasing the rents becomes necessary to maintain their incomes. There are few opportunities for tenants' involvement in improving the environmental quality of their settlement(s). This paper does not seek to add to literatures, instead, it concentrates on what might be done to improve the condition of tenants through development programmes and other interventions. As the discussion in the paper shows, whilst in general, there have been few policy and programme initiatives to address the needs of those living in rented accommodation, neither organizations nor government(s) have sought to work with tenants in improving the range and quality of the accommodation options available to them. It is hoped that this paper will be effective in promoting tenants and their needs and will encourage a wide range of learning and practical initiatives.

2.0 THEORETICAL FRAMEWORK (HABITABILITY MODEL) AND LITERATURE REVIEW

The issues involved in housing whether low, medium or high income group is more than shelter. The habitability of a house is influenced not only by the engineering elements but also by social, behavioral cultural and other elements in the entire socio-environmental system. (Awake, 2005).

What constitutes habitability vary according to the surrounding circumstances and because the satisfaction of human beings cannot be absolute, the habitability of a housing unit or the satisfaction of the tenants at a point in time can be meaningfully defined only in relative rather than absolute sense.

Habitability, as will be used in this study, refers to a type of tenant, dwelling, environment and management interaction system. This system produces a type of dwelling which is regarded by the tenant component of the system as relatively acceptable or adequate and therefore habitable, in the light of what tenants consider to be their housing needs and expectations.

As described above, habitability is portrayed as a human concept which involves four interacting subsystems namely the tenant subsystem; the dwelling subsystem; the environmental subsystem and the management subsystem. (See Figure 1.1)

Relating Figure 1.1 specifically to the focus of this study, the adequacy of a housing unit as determined by the internal space, the structural quality, the household facilities and other such amenities and qualities, as well as the form of ownership, will to a large extent influence the level of satisfaction of the inhabitant. However, previous studies carried out by Agbola (2007), United Nations Housing rights Programme (2003) among others have shown that housing unit by itself is not the only factor or the determinant of housing need satisfaction. The unit is only a part (a subsystem) of the whole (the system) which constitutes habitability. (Michelson, 1970; Back, 1962).

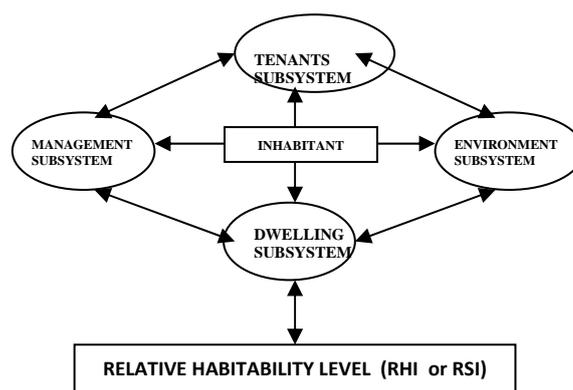


Figure. 1.1 Housing Habitability System (Adapted from Egunjobi 2007)

Olatubara (2007) quoting Onibokun (1973) said that the housing unit as a part of an environment and the inhabitants, through the interaction process, inevitably come into contact with the various components of their environment. As mentioned earlier, the components of the environment will have an influence, negative or positive, on the inhabitants' state of mind within the environment.

At the centre of the habitability system is the inhabitant (the fourth system), arbiter of what constitutes habitability. The inhabitant is the recipient of all the feedbacks from all the systems and is, therefore, the central focus of the conceptual model of habitability on which a study of housing should be based.

Thus, in a simplified sense, assessing habitability means evaluating the level of satisfaction of a tenant living in a particular housing unit which is a part of a housing stock and is located within a particular community and managed under a type of Institutional management.

There are also several views on who the occupants of rental housing are and the factors which influence their housing consumption. Olutayo (2007) described rental-housing sector in a large city as a case of a monopolistic competition among a large group of sellers. He observed that the product is differentiated by quality, location and layout, rooms per unit, etc. Hence, within each of the smaller sub-markets, different rents may be charged based on the quality differentiations of the individual units.

One school of thought as typified by Ingrain (1984) posits a basic sociological and demographic difference between households who rent and those who choose to own their own buildings. For example, he reported that rental households in Bogotá and Cali, Columbia, have younger heads, smaller families and lower income than owners.

Howenstine (1981) also cited special groups which prefer rentals - the more highly mobile, the younger and the more newly independent. The importance of these views is that there will be a base level of demand for rental housing in any city or country related to the population of these special groups.

Whatever the actual causes of demand for rental housing, conditions associated with high demand for rentals are likely, for the foreseeable future, to remain typical of most Nigerian cities. High birth rate and family formation, inflationary pressure, high rate of migration, etc. assume a continuing presence of the types of households likely to be prime consumer of rental market.

Besides these basic sources of demand, Agbola (2007) quoting evidence from the literature and other developing countries pointed to a number of features which characterize the demand for rental housing to include:

- household income of renters found to be generally low as compared to home owners (Mayo *et al*, 1965)
- renter generally seem to demand less space than home owners (Mayo *et al*, 1965; Lemer, 1980)

- Security of tenure, widely cited as a major advantage of home ownership is valued higher by renter as well. (Friedman *et al*, 1985)

All these features reinforce the continual dominance of rental housing sector. Its importance cannot therefore be overemphasized in any genuine effort to formulate a Housing Policy.

3.0 THE STUDY AREA

Ibadan, the capital of Oyo State and the largest indigenous city in West Africa was found as a war camp during the inter-tribal war in 1829.

The city lies between latitude 71° and 72°, North of the equator and latitude 34° and 35° East of the Greenwich Meridian, falls within the Western plains and are underlined by metamorphic rocks derived from pre-Cambrian rocks. The characteristic landscape consist expansive plains broken by North/South quartzite steep-sided ridges, which occur simply or in groups to give the insulting terrain of the city. The relief of a settlement usually dictates the type of drainage that can be found within such settlement. Ibadan is drained by two major rivers- the Ogunpa and Ona rivers. The former drains the eastern while the latter drains the western parts, thus, rising in the northeastern section of the areas. The Ogunpa River flows south-eastwards breaking through the central ridge turning south a course that is parallel to the ridge.

In the year 1901, the railway line was constructed from Lagos to Ibadan. This promoted trade and marked the beginning of a new era. Similarly, it represented new system of commercial articulation, which enabled the produce of the land to be exported to the outside world. Ibadan city, therefore, emerged as one of the most important education, commercial and administrative centres in Nigeria.

Ibadan, the capital city of Oyo State, South Western Nigeria with a population of 3,078,400 (three million, seventy eight thousand, four hundred) according to the census of 2010 has five Local Governments in her metropolitan area. The metropolis which is growing in its leaps and bounds has so many slum developments. Identified low- income residential neighbourhoods in Ibadan metropolis include Beere, Yemetu, Ijokodo, Eleyele,



Sango,
Apata
etc.

a

No of People/Room	No. of Resp.	%
1 – 3	141	16
4 – 7	669	77
above 7	60	07
	870	100

4.0 METHODOLOGY

In order to obtain detailed information, investigation started with a pilot survey while structured questionnaire relating to the study were drawn up and administered on respondents randomly. On the whole 1000 questionnaires were administered and the 870 retrieved questionnaires were analyzed using simple tables and summarized hereunder.

5.0 DATA ANALYSIS/RESULTS AND DISCUSSIONS

TABLE ASOCSA 2011-52.1 Showing No. of People Per Room

Despite the several regulations and the level of education as evidenced in Table ASOCSA 2011-52.1, many of the buildings are densely populated as over 80% of the respondents said that they are more than 3 in a room. This means the areas are overcrowded and congested.

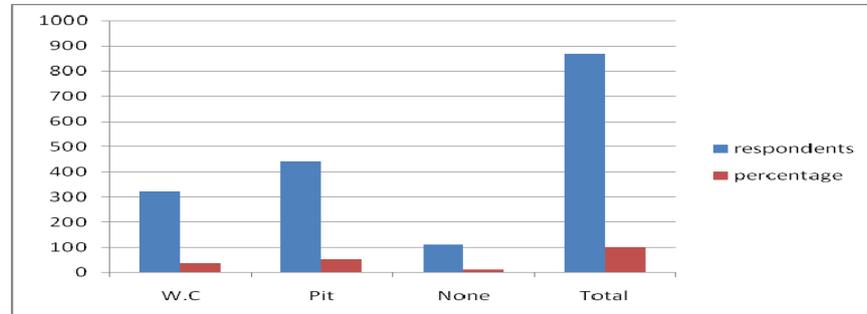


Fig. 1.2: Facilities Provided

From the survey as shown in Fig. 1.2, 63% of the respondents have access to primitive ways of sanitary disposal with only 37% having the modern means. It implies that the way human waste is disposed can hamper the health of the society.

As shown in table ASOCSA 2011-52.2, the main source of water supply for most of the respondents was through sunk well which were either untreated or unfit for human consumption. This is real term could affect the healthy living of respondents. Also, access which is an important aspect of any settlement is sub-standard as evidenced by 76% of the respondents claiming that it was not motorable or through paths. This allows for clustering of houses and hence slums.

95% of the respondents said that the drainage condition was not good and over 80% of the respondent do not dispose of their waste in a healthy and appropriate manner.

TABLE ASOCSA 2011-52. 2: Amenities Provided

Water Source	No. of Respondent	%
Sunk Well	511	59
Pipe borne (public)	127	15
Bore hole (treated)	92	10
None	140	16
Total	870	100
Accessibility	No. of Respondent	%
Tarred motorable	217	24
Unmotorable	519	59
Path	103	12
None	31	05
Total	870	100
Drainage Condition	No. of Respondent.	%
Poor	599	67
Fair	233	28
Good	38	05
Total	870	100
Refuse Disposal Mode	No. of Respondents.	%
Dunghill	238	28
Open space	212	24
Public incinerator	111	11
Drainage	264	31
Private	45	06
Total	870	100

TABLE ASOCSA 2011-52. 3 Residential Problems of the Low-Income Dwellers

Problems of	Respondents			Percentage %		
	Yes	No	Total	Yes	No	Total
Application of Urban Renewal Policies	801	69	870	92	08	100
Legislative protection for Slum dwellers	870	00	870	100	00	100
Access to Bank Credit	763	107	870	87	13	100
Unity among Tenants	233	637	870	26	74	100
Ownership of Rented Apartments	222	648	870	23	77	100

6.0 DISCUSSION OF FINDINGS

The study finds that the types of problems faced by the low income neighbourhood dwellers in Ibadan fall under the categories as found in table ASOCSA 2011-52.3.

The central slum neighborhoods in Ibadan especially those in the historic city centre such as Beere, Sango, Yemetu etc. are the subject of contradictory town planning and urban renewal policies applied by governments as evidenced by 92% of the respondents. The process of urban renewal undertaken focuses on the re-development of public areas – squares, avenues and roads – with the aim of making traffic flow smooth, reducing environmental deterioration and improving the city's aesthetics.

Furthermore, most statutory reforms, as discussed by the respondents, give priority to protecting property rights and land ownership. Tenants have no rights to an adequate standard of housing or to any degree of protection against arbitrary decision-making. Rents are

established by the market and subjecting tenancy to free market whims is already leading to evictions from private and government properties.

In addition, 87% of the respondents posited that housing loans are only accessible to families with a monthly income which is attractive to them and they charge an annual interest rate of at least 22 % which is far beyond the reach of low-income families from becoming owner-occupiers. Access to other loan programmes is hinged on other social inter-personal connection or even political affiliation.

Also, the respondents said that there was no unity among the low income dwellers due to the predominant cultural pattern noticed in most settlements. Many low-income neighborhood dwellers suffer problems such as drug abuse, street violence as well as alcoholism without seeking ways of resolving them in a systematic and sustained manner. These factors, combined with overcrowded living conditions, inadequate basic service provision and poor environment (such as lack of ventilation and sunlight), exacerbate violence and aggression within and between families cause them to engage in survival of the fittest.

As shown in the table ASOCSA 2011-52.3, only 23% talked about ownership problem and the remaining 77% said no to the issue of ownership, this means that most of the respondents are actually tenants and thus have no ownership issues.

7.0 CONCLUSION AND RECOMMENDATIONS

This paper has looked into the quality of life of low-income residential neighbourhood dwellers, who are mostly tenants, in Ibadan metropolis and made revealing discoveries. Actionable recommendations to better address the needs of low income residential dwellers include but is not limited to the following;

A considerable proportion of low income urban dwellers meet their needs for housing through the rental sector and, in many cities, the rental sector is growing in absolute numbers. It is inconceivable that all urban residents can meet their accommodation needs through home-ownership.

Those with responsibility for housing issues and policies as the management subsystem need to look more carefully at the kinds of interventions that might be effective in improving the supply of rented accommodation (hence the choices open to tenants) and the quality of such accommodation.

In addition, the situation of tenants can be improved through deliberate interventions to increase the supply of rental housing. An alternative approach to increasing the supply of private accommodation is the development of public and non-profit housing.

Further more, legal approaches should be sought at solving tenants' problems with a concern to ensure that appropriate laws and regulations are in place to protect both tenants and landowners.

Also, strong representative tenants' movements to enable tenants work with professional agencies involved in housing and urban development at both a community/town and city level should be formed. Such involvement should ensure that proposals, policies and programmes are effective in addressing tenants' needs by

- forming policy interventions that make effective and realizable proposals for improving the legislative framework;
- monitoring market conditions and informing interested parties of changes in the situation faced by tenants;
- providing legal advice and support when individual tenants are threatened; and
- enabling tenants to act together to increase the options that are open to them and to lobby for acceptance of these options by state agencies.

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ASOCSA2011-46

Timely Project delivery: a case study of Malawian educational projects

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ABSTRACT

Purpose of this paper: The completion of construction projects in a timely manner is often a critical factor and measure of project success. However, in many cases, delays plague the delivery of construction projects in many parts of the world. The purpose of the paper is to critically evaluate the performance of the UK-funded Education Sector Support Programme (ESSP) infrastructure projects in Malawi, with respect to timely completion.

Design/methodology/approach: The research uses a case study approach, which critically evaluates the extent of schedule overruns through the collation and analysis of secondary data from the portfolio of projects administered by Malawi's Education Infrastructure Management Unit (EIMU) between 2003 and 2008.

Findings: A significant number of the educational projects administered under the ESSP have been plagued by delays, and other project management and delivery problems. Out of 184 contracts administered between 2003 and 2008, less than a third of them achieved timely completion and yet the liquidated damages clause was only enforced in 29% of the 111 delayed projects, leaving contractors to complete at their own time. Furthermore, the mitigation measures put in place to prevent poor project performance do not seem to have the desired effect.

Research limitations/implications: The scope of the research is limited to the construction programme directly administered by the Education

Infrastructure Management Unit (EIMU), which only covers projects from the Education Sector in Malawi. In addition, no attempt was made, in this phase of the research, to explore the specific causes of delays. Doing so would have provided a contextual perspective to the issue of timely delivery.

Originality/Value: The paper contributes to the knowledge base on infrastructure project delivery in developing countries. The findings should be of interest to a wide range of stakeholders involved in the delivery of public projects including government departments, external funding organizations, non-governmental organizations, academics and practitioners in relevant fields.

Keywords: Aid, Delays, Developing Countries, DFID, Infrastructure, Malawi.

1.0 INTRODUCTION

The problem of delays in the construction industry is a global one (Sambasivan and Soon, 2007). As a result, the literature is replete with studies investigating delays in various countries worldwide, including Nigeria (Dlakwa and Culpin, 1990, Mansfield et al., 1994; Abinu and Jagboro, 2002), Saudi Arabia (Al-Khalil and Al-Grafly, 1999), Jordan (Sweis, et al, 2008), Zambia (Kaliba et al., 2009), Ghana (Fugar and Agyakwah-Baah, 2010), Thailand (Ogunlana et al., 1996), Malaysia (Sambasivan and Soon, 2007).

When delays occur on construction projects, they can have serious consequences. Sambasivan and Soon (2007) found the six main effects of delay on construction projects in Malaysia to be cost overruns, time overruns, disputes, arbitration, litigation, and total project abandonment.

All these effects of construction delays have the potential of adversely affecting a project's ability to achieve its objectives. As a result, the completion of construction projects in a timely manner is therefore almost always a critical measure of project success.

The scope of the research is limited to the construction programme directly involving the Educational Infrastructure Management Unit (EIMU). The size and scope of the programme administered by EIMU justifies its study. It is the largest in the Education Sector in Malawi, employing approximately 30 to 40 contractors annually to deliver a combined average output of 300–500 classrooms. Annually 5-6 Architectural consulting firms, (almost 30% of all such firms in Malawi), are engaged on ESSP projects.

The purpose of the paper is to critically evaluate the performance of these UK-funded projects under the Education Sector Support Programme (ESSP) in Malawi, with respect to timely completion. Over the years, there have been concerns regarding the performance of these projects. Such a

review is even more important at this time when the UK's foreign aid budget remains unchanged while British taxpayers are feeling the economic squeeze at home due to the various measures introduced by the government to reduce the country's huge national debt.

2.0 THE CHALLENGE OF TIMELY PROJECT DELIVERY

Due to the global nature of the challenge of delays in the delivery of construction projects, there is a vast amount of literature on the subject. A selection of literature is reviewed, focusing on studies conducted in a handful of sub-Saharan African countries. Such a review provides an excellent perspective of the extent of the problem of delays in other similar developing countries, together with the causes as well as mitigation measures. The choice of studies from other African countries provides a good basis for performance comparison because the conditions affecting the selected countries will be similar to those experienced in Malawi.

2.1 Delays in construction projects in Ghana

Frimpong *et al.* (2003) identified five factors, out of a list of 26, as the major causes of delays to projects in Ghana as: monthly payment difficulties to contractors, poor contract management, material procurement difficulties, poor technical performance and material price escalations. They recommend effective and efficient management of projects as the ultimate solution to time overruns.

More recently, Fugar and Agyakwah-Baah (2010) also reiterated that delays in construction projects are still endemic in Ghana. They investigated a total of 32 factors causing delays in construction projects, which the research participants (clients, consultants and contractors) ranked according to the factors' order of importance. Based on their survey, Fugar and Agyakwah-Baah (2010) found that the top ten factors associated with delays in construction projects in Ghana were:

- i. Delays in honouring payment certificates
- ii. Underestimation of the project costs
- iii. Underestimation of the project's complexity
- iv. Difficulties in accessing bank credit
- v. Poor supervision of the works on site
- vi. Underestimation of the time for completion of the projects by the contractors
- vii. Material shortages
- viii. Poor professional management
- ix. Fluctuation of prices / rising cost of materials
- x. Poor site management

In order to mitigate the effect of the common causes of delay, Fugar and Agyakwah-Baah (2010) recommended that clients should ensure that they have sufficient project funds, they make speedy payments for work, whilst contractors must have competent personnel for the project.

2.2 Delays in construction projects in Nigeria

Dlakwa and Culpin (1990) outlined the reasons for time overruns in public sector construction projects in Nigeria. These included late interim payments to contractors, deficiencies in the contractors' organizations, poor planning and scheduling, contractors' unrealistic tenders, unrealistic contract durations imposed by the client, additional work, unexpected natural or social events, inadequacy of site inspectors and shortage of qualified staff.

Mansfield *et al.* (1994) identified the four most important factors causing delays and cost overruns in Nigerian construction projects as, financing and payment for completed works, poor contract management, changes in site conditions, and shortage of materials. Other factors identified included inaccurate project estimation and price fluctuations.

More recently, Nwachukwu (2009) used a systems approach to analyze the effects of materials constraints to project management success in construction in Nigeria. The study concluded that the attitude of the client and the project management team towards materials management is very important because it has a marked effect on the achievement of the project goal. For instance, delays in the procurement of materials will negatively impact the construction programme and may result in delays and failure to achieve timely project delivery.

2.3 Delays in construction projects in South Africa

In South Africa, Bowen *et al.* (2002) examined the views of contractors and business professionals regarding the causes of delays in construction. Client-induced changes were found to contribute the most to time overruns on construction projects in South Africa.

Like Nwachukwu (2009), Ganesan and Theo (2005) also advocate a systems thinking approach to help minimize construction project failure in South Africa. Citing Hindle (1996), Ganesan and Theo (2005) argue that fragmentation of the building delivery process is by far the biggest single problem leading to project failure. Professionals and other stakeholders are encouraged to participate in projects with a big picture viewpoint rather than simply focusing on their own small part in the project. This way, projects are more likely to be more successful because of the emphasis on the wider project and its objectives.

Samuel (2008) examined six government projects in South Africa to determine the root causes of their failure. Poor project management was found to be the basic problem leading to contractors failing to complete construction projects on time and within budgets.

Similarly, Phaladi and Thwala (2009) also found management-related issues as major causes of poor project performance for the small and medium sized contractors in South Africa. Lack of effective management in the early stages of the projects, coupled with inadequate finance, lack of credit facilities from suppliers, inadequate skilled manpower, poor pricing and tendering, inadequate contract documentation skills, and generally lack of proper management training were the major factors contributing to contractors' failure to execute projects successfully.

In order to forestall the challenge of timely project delivery, Samuel (2008) recommends that project time management be a key priority for the contractors and that the appointment of a registered project manager for each contract should be a mandatory condition of tender.

2.4 Delays in construction projects in Swaziland

Amongst small and medium size contractors in Swaziland, Thwala and Mvubu (2008) found that factors such as financial constraints, relationships with suppliers, late payments by clients, lack of necessary capacity and competence to achieve success, were some of the key factors for unsatisfactory performance on construction projects. However, they are quick to point out that the problems facing the small and medium contractors are not unique to Swaziland.

2.5 Delays in construction projects in Uganda

A study of clients' performance in construction projects in Uganda (Alinatwe, 2008) found that failure to pay advance payment to contractors as provided for in the contract led to poor contractor cash flow leading to project delays. Out of the clients surveyed, 89% did not provide any bonus to the contractors as an incentive for timely completion and that more than 90% of the clients do not support training for the contractors. In addition, variation orders and delayed payments by client were also identified as causes of project delays.

2.6 Delays in construction projects in SADC & East Africa

Rwelamila (2002) comprehensively reviewed the problems affecting performance in the construction industries in the Southern Africa Development Community (SADC) region and East Africa. Citing several empirical studies, Rwelamila (2002) summarised the key problems negatively affecting performance in the stated construction industries as follows:

- Costly project delays due to division between design and construction,
- Lack of skilled labour and poor site supervision are two major problems influencing quality,
- Poor project time and cost performance,
- Inaccurate estimates of clients project financing,
- Variations issued without regards to original budget – affecting project cash flow,
- Lack of thorough briefs, skilful designs and specifications,
- Efficient site management lacking,
- Delay in payment of contractors,
- The culture to plan meticulously and commitment to controlling the project has not entrenched itself in the construction industry in Kenya, and
- Occurrence of variations – considered to be a reflection of incompetence in design, lack of application of constructability and poor project planning and control.

Other country-specific studies on project performance have been undertaken in Southern Africa. For instance, Adolwa (2002) evaluated an advance loan scheme put in place by the Botswana government to assist small building contractors with project mobilization. The study found that the scheme was not as successful as intended due to misuse of the loans. Adolwa recommended further training of the contractors as well as monitoring of their progress to ensure success.

In another country-specific study, Kaliba *et al.* (2009) investigated cost escalations and schedule delays in road construction projects in Zambia, which yielded a list of 14 major causes of delay. Starting with the highest ranked factor, Kaliba *et al.* (2009) reported: delayed payments, unduly protracted financial processes, financial difficulties, contract modification, economic problems, material procurement problems, changes in the drawings causing variations, staff problems, equipment unavailability, poor supervision, construction mistakes made by the contractor on site, poor coordination on site, specification changes and labour problems. Kaliba *et al.* (2009) recommend the use of efficient project management tools and practices as a major step to minimize the causes and effects of delays and cost overruns.

A summary of the causes of delays identified in the selected sub-Saharan African countries is shown in Table 1. The table shows the most commonly cited causes of delay in the studies reviewed in this paper.

Table 1: Top 10 Causes of delays in selected sub-Saharan countries	Ghana	Nigeria	Uganda	South Africa	Swaziland	SADC & E. Africa	Botswana	Zambia
Delayed Payments	X	X	X	X	X	X	X	X
Poor Project Planning	X	X	X	X	X	X	X	X
Poor Site Management	X	X	X	X	X	X	X	X
Poor or lack of communication between parties	X	X	X	X	X	X	X	X
Site conditions	X	X	X	X	X	X		X
Shortages/delays in supply	X	X		X	X	X	X	X
Labour supply	X	X	X	X	X	X		X
Change orders (variations)	X	X	X	X		X	X	X
Contractors' inadequate cash-flow	X	X		X	X	X		X
Underestimation of project costs	X	X	X	X	X	X		

As shown in Table 1, all the top 10 delay factors in the selected countries are primarily management issues. Rwelamila (2002) concluded that the lasting solution to the problems identified in the selected countries was for Construction Industries in Africa to modernize. However, a critical requirement for success would be for all the relevant stakeholders in the industry to be committed to such a transformation. Any solutions would therefore have to address the failure of project management which is a recurring theme in construction projects.

3.0 RESEARCH METHODOLOGY

The study investigated project performance on Malawi's ESSP projects using a case study approach in which secondary in-house client's project documentation were systematically reviewed, data collated and analysed. The study is limited to ESSP projects commissioned between 2003 and 2008. The secondary data reviewed over 180 project files to provide an overview of the projects undertaken during the stated period.

4.0 SECONDARY DATA ANALYSIS AND FINDINGS

4.1 Case study background

Malawi is a southern African landlocked country which has an estimated population of 16million and a per capita (PPP) GDP of \$900 (2010 est.). The country is very densely populated although nearly 80% of its population live in rural areas. Malawi is primarily agricultural-based while the economy depends on substantial economic assistance from the IMF, the World Bank, and individual donor nations. In 2006, the country received relief, having been classed as one of the Heavily Indebted Poor Countries (HIPC).

Prior to the advent of multiparty democracy in Malawi in 1994, about 40% of eligible children were enrolled in primary School. Subsequently, the new government introduced free primary education which resulted in enrolment increasing from 1.8m in 1993 to 2.8m in 1994 (GOVERNMENT OF MALAWI 2007). This increase in demand for primary education brought about challenges like shortage of teachers, inadequate text books insufficient classrooms and teachers' accommodation.

As Malawi's biggest bilateral donor, the UK government has committed itself to long term support. This assistance is provided through the UK government's Department for International Development (DFID).

"DFID is the largest donor in education and expects to continue to play a lead role. Support to date, has focused on building classrooms, curriculum reform (and new text books), teacher training, and strengthened accountability" (DFID-MALAWI, 2007: 28-29).

Under the new UK coalition government, DFID recently renewed its commitment to funding development initiatives, including secure schooling for 11 million children around the world. However, the government was careful to reassure the UK taxpayers that it would ensure that UK aid works better by focusing on a number of performance criteria including "getting value for money from every pound of aid we spend" (DIFD, 2011).

From 1995, DFID funded the construction of 130 new schools under the Primary Community Schools Project (PCoSP) and completion of 200

classroom blocks under the Primary Education Programme (PEP). Building on the successes of these programmes, DFID initiated the ESSP in 2001.

Table 2 shows that DFID is a major player in the provision of educational infrastructure in Malawi. Between 2004 and 2008, DFID funded the construction of nearly 60% of Malawi's classroom construction, compared to a mere 20% by the European Union's Micro-projects unit.

Table 2: Major organizations Funding Educational Infrastructure in Malawi

NUMBER OF CLASSROOMS BUILT PER YEAR (Numbers of Houses in brackets)						
Organisation	Districts	2004/05	2005/06	2006/07	2007/08	Total
DFID/EIMU	7	1,208 (73)	476 (10)	307 (48)	544 (156)	2,535 (287)
EU Micro-projects Unit	Nationwide	276 (81)	131 (41)	131 (42)	268 (67)	806 (221)
MASAF	Nationwide	170	170	180	-	520
Clinton-Hunter Foundation	4	-	-	-	125	125
SCF- USAID	4	33	33	33	-	99
GOPA	Nationwide	78	-	-	-	78
UNICEF	6	-	-	-	60	60
UNDP	1	-	-	48	-	48
SCF	1	-	-	14	14	28
ICEIDA	1	8	-	-	-	8
					Total	4307 (508)

Source: EIMU Office – Used with permission

Currently, the Ministry of Education, Science and Technology (MOEST), through its implementation unit, EIMU, which became operational in January 2008 is responsible for the delivery and maintenance of

educational infrastructure. Through this arrangement, DFID has continued to fund educational construction projects in Malawi.

The main purpose of the research is to investigate the timeliness of the delivery of educational projects in Malawi's DFID-funded projects. The research is limited to studies on the annual Primary Schools Construction Programme, which is only one component of the ESSP scheme.

4.1 Procurement arrangements on ESSP Projects

The ESSP projects are typically procured using a traditional procurement model with Architectural consultancy firms employed as lead consultants or client's contract administrators. In order to promote capacity building within the local Malawian Construction Industry, indigenously owned construction firms, Architectural and Quantity Surveying consultancy firms have been used in the ESSP scheme.

Each year, approximately 30 to 40 contractors are engaged to deliver a combined output of 300 to 500 classrooms. For instance, in 2007-08 alone, a total of 44 projects were awarded with a combined value of 1.2 billion Malawi Kwacha (£5.5million).

Design and Scope of Works

Annually the MOEST determines the projects to be undertaken by its implementation unit (EIMU), according to existing priorities and needs. The construction projects are typically a combination of between 2 to 12 primarily classrooms and 1 to 4 teachers' houses. Occasionally, other facilities such as administration block may also be part of the projects. Each project is different in scope which is reflected in the contract duration ranging from 10-26weeks.

The buildings have standardised designs, generally constructed of reinforced concrete foundations, load bearing block wall and stabilized soil blocks, roof with timber trusses and parry concrete tiles, steel windows, steel doors and frames, plastered wall finishes internally and pointed externally.

The Contracts

The ESSP projects use a standard form of contract, the Malawi Government Standard Conditions of Contract (1984 Edition, Modified). Contractors are invited to tender on the basis of firm bills of quantities, although the earthworks and external works are normally subject to re-measurement.

Contractor selection

The open system of tendering is used but only pre-qualified contractors are eligible to tender for work under these DFID-sponsored ESSP projects. Contractors registered with the National Construction Industry Council (NCIC) are assessed on criteria such as financial standing, technical standing, past experience and qualification, and experience of key personnel. Despite the use of pre-qualification, which is aimed at ensuring that the selected contractors have the desired capacity, experience and expertise, the ESSP projects are still fraught with poor performance.

4.2 Contractor Performance on ESSP Projects

In 2003, DFID in partnership with the then Infrastructure Management Unit (IMU) started the annual primary school construction programme on a pilot basis in selected districts. One such district was Ntchisi, a small agricultural town located about 98km north of Malawi's capital city. One of the major challenges to emerge from the pilot phase was the failure by contractors to complete the pilot projects within the contract period. The Construction Advisor for IMU did not disguise his frustration concerning the performance of the projects during the pilot phase in project correspondence to one of the project consultants:

"The poor performance of these contractors has caused immense difficulties to this programme as we have never been able to evaluate the pilot schools before the start of the main construction programme. It has also led to a decline in the performance of most contractors in Ntchisi as they are not worried about the consequences of failing to meet their planned programmes as they see these contracts dragging on with no action by the consultant or client" (IMU 2004).

Although three of the projects involved were eventually terminated, the above raises a number of issues relating to project implementation. Clearly, the problem and impact of delays in project delivery were noticed as early as August 2004. However, the trend seems to have been permitted to continue for another four years with little or no real changes. ESSP projects have continued to suffer perennial failure with many of the contractors failing to deliver projects within the stipulated contract period.

Table 3 below provides case study data of the ESSP projects executed between 2003 and 2008 in Malawi.

Table 3: Project performance on ESSP Projects

Year	Total No. of Projects	Completed within original time	Granted EOT	Completed within EOT	Late despite EOT	Late without EOT	All Late Projects
2003-04	17	4 (23%)	13 (77%)	2 (12%)	11 (65%)	0	11 (65%)
2004-05	53	1 (2%)	52 (98%)	14 (26%)	38 (72%)	0	38 (72%)
2005-06	41	10 (24%)	30 (73%)	11 (27%)	19 (46%)	1(3%)	20 (49%)
2006-07	29	11 (38%)	16 (55%)	2(7%)	14 (48%)	2 (7%)	16 (55%)
2007-08	44	7(16%)	37(84%)	9 (20%)	28 (64%)	0	28 (64%)
Totals	184	33 (18%)	148 (80%)	38 (21%)	110 (59%)	3 (2 %)	113 (61%)

Out of all the ESSP projects reviewed, only a third (33%) were completed within the original contract duration. Owing to the nature of the delays, a significant number (80%) of the projects were granted extension of time (EOT), with some up to as much as 178weeks! Out of all the contracts granted extension of time, less than a third (21%) of them were completed within the extend period. A significant number of the projects were therefore delayed by up to 124 weeks. The performance of the contractors, in terms of timely completion, has clearly been mediocre. However, the failure by the client and their advisors (consultants) to enforce the conditions of contract also seems to be perpetuating the problem.

4.3 Mitigating Poor project Performance

Due to the poor performance of the contractors, the client instituted mitigation measures aimed at improving contractors' performance and enhancing timely project completion. These measures include payment of advances for mobilization and material procurement, bonus payments as an incentive for early completion, assistance to procure materials, and

waiver of damages. This section is an analysis of whether these measures have been effective or not.

4.3.1 Advance Payments

The standard form of contract used on all the ESSP projects has a provision for advance payments of 20% of the contract sum to be made to the contractor at the start of the project. The measure was introduced in 2001 to alleviate cashflow problems faced by many of the contractors involved in the ESSP projects.

Proponents of the issuing of advance payments to contractors argue that they are beneficial to the smooth running of projects as they help forestall delays by decreasing the contractor's financial burden during mobilisation, purchasing of essential materials and hiring of plant and equipment (Hussin and Omran, 2009). However, in spite of being a well-intended and useful facility, advance payments are often ineffective as a long-term measure for improved construction industry performance. In Botswana, Adolwa (2002) found that both the contractors and the body administering the advance mobilization loan to the contractors believe the cash advance facility is important and effective. However, the biggest factors negatively influencing the loan effectiveness was misuse of the money and general lack of management skills to effectively utilize it.

4.3.2 Bonus Payments for Early Completion

Another unique feature of the ESSP projects is the inclusion of a bonus clause in the conditions of contract. The clause entitles contractors to a bonus of 2% of the contract sum per week, for every week or part thereof that they complete the works before the date for completion, up to a limit of 10% of the contract sum. When projects are completed before the date for completion, consultants involved on the ESSP projects are also entitled to a bonus amounting to 0.25% of the contractor's bonus amount.

Advocates of incentive schemes argue that incentives such as bonus can incentivise more contractors to complete their projects before the date for completion. For instance, Assaf and Al-Hejji (2006) identified the unavailability of incentives to contractors who complete projects before the date for completion as one of the root causes for delays in the Saudi Arabia construction industry. However, the types of incentives were not identified in the Saudi Arabian study. Others like Odeh and Battaineh (2002) recommend the provision of training incentives to develop the human resource capacity in the construction industry in Jordan. The incentive, they say, could be by way of offering tax deductions on money spent on training.

Although this feature of the contract is inevitably popular amongst contractors and consultants, the case study data in Table 4 shows that only a very small percentage of the contractors actually benefit from it.

Table 4: Percentages of Bonus recipients

Construction Period	Contracts awarded	Contracts with Bonus
2003–2004	17	2 (12%)
2004–2005	53	12 (23%)
2005–2006	41	12 (29%)
2006–2007	29	9 (31%)
2007–2008	44	4 (9)
Total	184	39 (21%)

Source: EIMU; used with permission

Inevitably, the actual contractors who managed to earn bonuses in each of the periods under consideration were large, well established construction companies. Since the ESSP scheme mainly employs small and medium size construction firms, it seems that the bonus facility has, so far, not been beneficial to them. This seems to defeat one of the core purposes of the bonus scheme, which was to help develop contractors' capacity. Arguably, the sums of money spent by the client in this manner may be better spent in others ways such as providing training to least performing contractors.

4.3.3 Assistance to Procure Materials

There is divided opinion from the various stakeholders as to whether the client should assist the contractors to procure materials. Contractors on ESSP projects may request the client for financial assistance to pay for materials directly to suppliers. In cases where a contractor is experiencing cash flow problems and has no credit facilities with suppliers, such a measure on the part of the client may be essential to ensure that progress of the works is not hindered. However, such measures may not be useful in developing financial prudence and long-term capacity of contractors. On the contrary, the result may be perpetual contractor dependence on clients and perpetual poor management finances and projects.

4.3.4 Waiving liquidated damages

Based on case study data, Table 5 below further highlights the extent of project delivery failure in the period under review, with specific emphasis on the enforcement of damages and the awarding of bonuses for early completion.

Table 5: Enforcement of liquidated damages and awarding of bonuses

Year	Late projects	Damages applied	Damages waived	Terminated Contracts
2003-04	11 (65%)	0 (0%)	8 (73%)	3 (27%)
2004-05	38 (72%)	16 (42%)	22 (58%)	0 (0%)
2005-06	20 (49%)	7 (35%)	13 (65%)	0 (0%)
2006-07	15 (52%)	7 (47%)	8 (53%)	0 (0%)
2007-08	27 (61%)	2 (7%)	25 (93%)	0 (0%)
Totals	111	32 (29%)	76 (68%)	3 (3%)

(Source: EIMU; used with permission)

Out of all the delayed projects, less than one-third (29%) were subject to liquidated damages, while more than two-thirds (68%) had the damages waived in spite of the projects being delivered late. The client's rationale for waiving the liquidated damages clause is to prevent further financial burden on the contractors. The argument is that a contractor who fails to complete a project within the contract duration may already be under financial difficulties due to cash-flow problems. As such, penalising them with liquidated damages would simply make the situation worse.

However, it can be argued that the client's approach to project management, in particular the failure to enforce contract conditions, may be contributing to perpetuating poor project performance on ESPP projects in Malawi. Such a 'generous' gesture of routinely waiving liquidated damages for delayed projects may be counterproductive for construction industry development in Malawi in the long run. Contractors must be aware that by signing a contract to execute work in a given period of time, they need to be responsible enough to fulfil that commitment. Failure to fulfil their commitment should result in enforcement of the relevant contractual provisions.

5.0 CONCLUSIONS

Although the problems experienced by Malawi's educational infrastructure projects may not be unique, the extent of delays and poor project management is cause for concern. The client's initiatives in instituting measures to assist contractors to complete projects within the stipulated contract period do not seem to be adequate or universally successful. In

fact, it can be argued that they may simply be perpetuating dependency and irresponsible behaviour on the part of some contractors.

While the use of citizen construction firms is commendable, capacity building must go beyond that to address fundamental issues of wider construction industry development. The role of vibrant built environment-related professional bodies and the National Construction Industry Council (NCIC) in raising standards in the Malawian Construction Industry is crucial, failure to which many parts of the industry will continue to consistently underperform. Structural changes may be required to modernise practice at industry level as recommended by Rwelamila (2002). Other areas that will deliver some gains include training and professional development for both contractors' personnel as well as consultants responsible for the supervision and implementation of these projects.

Significant improvements and prudence in contract management are required in Malawi, especially in the delivery of construction projects that are donor-funded. Public opinion in the UK is increasingly becoming fragile and divided regarding the government's consistent funding of overseas aid projects such as the ESSP scheme. If such schemes are not seen to be delivering value for UK taxpayers, this may put negative pressure on future financial commitment for overseas aid projects.

The paper serves as a platform for further research to identify and critically appraise the causes of delay, with a view to determine the most effective measures for mitigating them.

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Assessment of emotional intelligence training provided to junior project managers in the construction industry

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ABSTRACT

Purpose: The purpose of this research is to gain an understanding of Emotional Intelligence (EI) and its role in construction project management. Furthermore, this research aims to determine when, and to what extent will construction organisations begin treating emotion seriously in their training and development programmes as well as in the project management process.

Methodology: The design of this research makes use of a quantitative approach and the methodology applied is a survey that involves the collection of quantitative data via a questionnaire. The primary focus, in terms of stakeholders, is located in the human resource department or the training division within a construction organization, depending on the internal structure of each organization. Personnel e.g., training co-ordinators, human resource managers or the person responsible for training within relevant departments was specifically targeted.

Findings: The main finding of this research was that all the construction organizations in the Western Cape provide poor training, in all of the EI competencies listed in the questionnaire, to their junior project managers. This argues that the opportunity to develop EI competencies in junior project managers is not very good and alternative research must investigate what the situation is at educational institutions, e.g. to what extent do they provide EI competencies in their curricula.

Limitations: The field of study is limited to the Western Cape. The value of this paper is the awareness it will create in the industry regarding emotional intelligence.

Keywords: Emotional intelligence, junior project managers, training, construction organizations.

1. INTRODUCTION

The attention Emotional Intelligence enjoy today, evolved from works by psychologists as early as 1920. Thorndike proposed a model of intelligence that not only included intellectual competencies, but also what he termed 'social intelligence', defined as 'the ability to understand and manage men, women, boys and girls to act wisely in human relations' (Thorndike 1920:228). Other theorists such as Gardner (1983:239) were convinced that factors, other than IQ, contributed to individual success. Wechsler (1985:17) made valuable contributions in the definition of intelligence, but it was only in 1990 that Salovey and Mayer invented the term "Emotional Intelligence" (EI). Five years after Salovey and Mayer published their work, Daniel Goleman published his first best seller "Emotional Intelligence: Why does it matter more than IQ" in 1995, followed by other books that was just as popular. Goleman (1995:10) argued that emotional competencies are the main factor influencing success in the life of any person, he claims that EI contribute 80%; where the trusted measured of cognitive ability IQ, only contribute 20% towards life success.

Goleman's work presented this EI concept in a persuasive, easy reading and convincing way. Although Goleman did not discover the concept, he did made the term EI more accessible to the layman, by making use of simple language and telling real life stories of EI applications. Goleman et al. (2002:39) made use of Salovey and Mayer (1990:191) EI model and mixed in many other personality traits that allowed the breakdown of EI competencies which can now be linked with performance and job satisfaction in project management and other fields.

Following Goleman's success, other researchers endorsed and added to Goleman's EI model, this lead to uncertainty and serious academic discussions among researchers around the validity of the EI concept, in part because EI are defined in too many ways (Law et al., 2004:438; Mayer et al., 2008:503). In defence Goleman's work was recently described as "a journalistic render of Emotional Intelligence" (Mayer et al., 2008).

2.0 DEFINITION OF EMOTION AND INTELLIGENCE

Goleman (1995:6) explains: the root of the word emotion is motere, the Latin verb "to move", plus the prefix "e-" to connote "move away", in other words emotions are in essence, impulses to respond.

Wechsler (1958:17, cited in Salovey & Mayer, 1990:186) stated, "Intelligence is the aggregate or global capacity of the individual to act

purposefully, to think rationally, and to deal effectively with his environment”.

3.0 IMPORTANCE OF EI IN CONSTRUCTION MANAGEMENT

Despite the emphasis on EI in the recent literature, there have been relatively few empirical studies on EI conducted within a construction sector context and so little is known of why EI competencies are so important to those choosing construction management careers (Mo & Dainty, 2007:110). To address this enquiry; research identified many factors that suggests the importance of EI in construction management of which, among other, only two are listed below. According to Druskat & Druskat (2006:88):

- As projects are temporary, project-based relationships often exist only for the length of the project, a subproject, or even a checkpoint or progress meeting. Project managers and professional team members frequently move quickly from one project onto the next. Therefore, building new relations through the use of interpersonal skills is very important to create a working environment that becomes quickly productive. EI competencies such as self-confidence, emotional self-control, transparency and empathy can help project managers to develop trust swiftly.

- Each project is unique with factors that would not have been considered before. In many cases projects commences without designs being finalised which result in changes to design throughout the projects life. This induces more stress on – time schedules, budgets, etc., and eventually on project managers. EI competencies in the self-management sub-category, such as self-control and adaptability may be necessary.

Without constructive relationships between the professional team, construction team and other stakeholders, these emergent challenges will be more difficult to overcome, increasing risk and cost to the project. Construction sites must be highly organized and managed by competent people to ensure optimum performance. All the above mentioned factors demand high levels of EI in addition to traditional management abilities which leading practitioners possess (Mo & Dainty, 2007:113).

Performance, effective leadership and job satisfaction are central to construction project managers and their organizations for their success (Dulewicz & Higgs, 2003:205; Law et al., 2004:494; Lopes et al., 2006:137). This research poses that, if EI competencies determine job satisfaction and performance in the individual project manager that in turn, contributes positively to an organization, surely it must be beneficial in the long term for an organization to train its PM's in EI competencies.

3.1 FOUR-BRANCH MODEL OF EMOTIONAL INTELLIGENCE

To ensure the validity of this report, this research considered EI models accepted by the originators of the EI concept viz.: Mayer and Salovey. Mayer & Salovey (2008:505) states that: "their four-branch model of EI provides one conceptually coherent approach". They redefine their first definition of EI as:

- a) the ability to perceive emotions in one self and others accurately,
- b) use emotions to facilitate thinking,
- c) understand emotions, and
- d) manage emotions so as to attain specific goals.

These four branches are illustrated in Figure 3.1

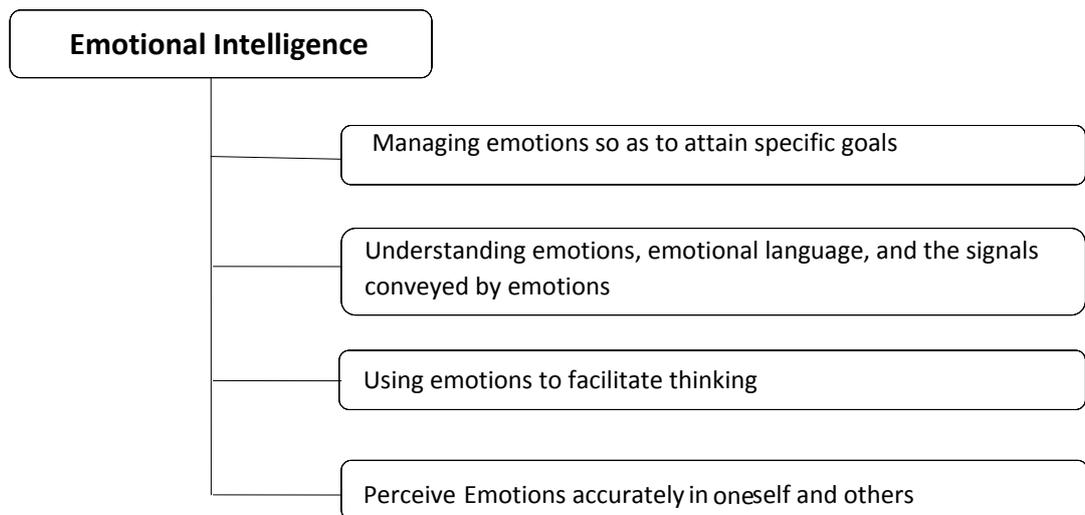


Figure 3.1: The Four-Branch Model of Emotional Intelligence (Mayer & Salovey, 1997:10)

3.2 THE IMPORTANCE OF EI IN PROJECT MANAGERS AND THEIR ORGANIZATIONS

3.2.1 PRODUCTIVITY IN TEAMS

Apart from the unique physical attributes to construction, relationships between people exist as with any other project. According to Druskat & Druskat (2006:88) as projects are temporary, project-based relationships often exist only for the length of the project, a subproject, or even a checkpoint or progress meeting. Project managers and team members frequently move quickly from one project onto the next. Therefore, building new relationships through the use of interpersonal skills is very important to create a working environment that becomes quickly productive. Studies in how EI correlates with better relationships in business settings have confirmed that managers with higher EI are better able to create productive working relationships and to demonstrate greater personal integrity (Rosete & Ciarrochi, 2005:392). Specific EI competencies such as self-confidence, emotional self-control, transparency and empathy can assist PM's to create a working environment that becomes quickly productive (Druskat & Druskat, 2006:88).

3.2.2 MANAGING UNCERTAINTY IN PROJECTS

Each project is unique with factors that would not have been considered before which are prone to evoke uncertainty and risk (*op. cit.*). It is for this reason, among many other, that constructive relationships between the client, professional team and other stakeholders must exist to overcome the challenges associated with uncertainty (Druskat & Druskat, 2006:88). EI competencies such as optimism, adaptability, initiative and organizational awareness will enable the project manager to effectively deal with unexpected changes (*ibid.*).

3.2.3 STRESS MANAGEMENT

In many cases projects commences without designs being finalised which result in changes to design throughout the projects life. This induces more stress on time schedules and programs resulting in project managers struggling to cope in such a demanding setting. Druskat & Druskat (2006:89), suggests that EI competencies in the self-management sub-category, such as self-control and adaptability may be necessary to prepare the project manager for unexpected challenges.

3.2.4 CROSS-CULTURAL ISSUES

Work relationships are frequently cross-cultural and interaction between team members needs to be stimulated through social interaction and team discussions (Kokt, 2003:82). Relationships in construction management are regularly cross-cultural, client-to-designer-to-contactor and organization-to-organization. The natural tendency of humans to better cooperate with its cultural counterpart and rejects those who are different creates risk

(Druskat & Druskat, 2006:89). EI competencies such as empathy, organizational awareness and service orientation must be high in order to overcome this tendency (*ibid.*).

3.3 THE RELATIONSHIP BETWEEN EI AND LEADERSHIP IN CONSTRUCTION ORGANIZATIONS

In their research to determine if a relationship exists between EI and leadership behavior Butler & Chinowsky (2006:125) concluded that, after examining 155 construction executives, not only does a relationship exist but a strong one. Their study also showed the higher a individual move up in his organization the more important EI competencies become, this relationship has significant impact for construction companies. "Specifically, as organisations prepare the next generation of executives, the criteria for selection as well as the development of the selected individuals should be expanded to recognize the value of EI and leadership traits" (*ibid.*).

4. RESEARCH APPROACH

A quantitative research approach was taken with the objective to establish to what extent construction organizations regard the importance of EI their training and development programs for junior project managers. Quantitative research refers to research that is concerned with quantities, measurements and answers the "how" questions in research (Biggam, 2008:86). Factors that contributed to determine the quantitative nature of this research was a combination of:

- A survey research strategy that was selected,
- The data required to address the research objective namely to determine to what extent training in EI skills development is provided to project managers, on junior level, employed by established construction companies in the Western Cape, which are concerned with measurement of quantities and asking the question of "how" much training are provided, and a questionnaire that are used for data collection.

4.1 SAMPLE SELECTION

"Established" construction organizations are identified, to isolate the variables of interest via the following procedure: Historic tender data, particular to construction companies, operating in the Western Cape who tendered on construction projects during the last 29 months (January 2008 – March 2010) was obtained via the tender database as published on the internet. 60 Construction organizations were identified which represents the total population.

The 60 construction organizations identified were categorized according to tender price through the use of a standard computer programme, Microsoft Excel®. The construction organizations that submitted tenders with a tender price greater than R 32.5 million were considered for this research. This grading designation of R 32.5 million and

more, selected to identify the sample unit, was identified by CIDB, (2010:1) to be a typical representation of organizations that are recognised as established contractors. The tender lists were reduced to 15 construction organizations and were compared with construction organizations that are actively registered under general building (GB) class of works and contractors grading designation 8 & 9 with the CIDB to ensure the reliability of the identified sample. 19 Construction organizations were identified that meets the aforementioned criteria and these organizations represent the sample units of the target population.

A questionnaire was prepared to determine the following:

- The extent EI skills training are provided to junior project managers employed by 19 of the largest construction organizations.
- The views of the construction organizations on the importance of EI skills in project managers within their organization.
- The level construction organizations prefer to introduce EI competencies training to project managers.

5.0 SURVEY RESULTS (ONLY SPECIFIC TO EI TRAINING PROVIDED)

In this section the participants were asked to indicate in which of the listed

Table 5.1:-Descriptive statistics of relevant personal's responses on self-awareness.

Variable	Category	Frequency	Percentage of total (o)
1. Self-awareness			
1.1 Emotional self-awareness	Poor	13	81.3%
	Average	2	12.5%
	Good	1	6.3%
	Excellent	0	0.0%
1.2 Accurate self-assessment	Poor	12	75.0%
	Average	4	25.0%
	Good	0	0.0%
	Excellent	0	0.0%
1.3 Self-confidence	Poor	11	68.8%
	Average	4	25.0%
	Good	1	6.3%
	Excellent	0	0.0%
Total Participants		16	

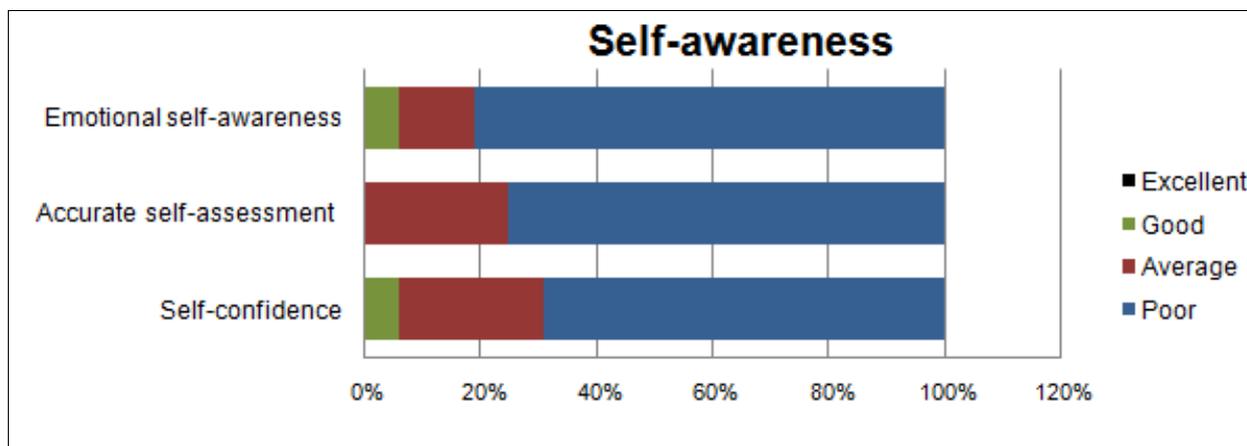


Figure 1: Self-awareness

The overall aim of the research was to gain an understanding of EI and its role in construction project management. Furthermore, this research aimed to determine when, and to what extent will construction organisations begin treating emotion seriously in their training and development programmes and project management process.

After considering the review of related literature and comprehensive data analysis utilising inferential statistical analysis, the core finding of this research is that: all the construction organizations in the Western Cape provide poor training, in all of the EI competencies listed in the questionnaire, to their junior project managers.

Opportunity to develop EI competencies in junior project managers is not very good and alternative research must investigate what the situation is at educational institution, e.g. to what extent do they provide EI competencies in their curricula.

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Application of Fast-Tracking Practices on Construction Projects – Evidence from South Australia

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ABSTRACT

Purpose: This study seeks to establish the reasons for implementing fast-tracking practices, and explore their impact on construction projects deliverables.

Design/methodology/approach: The data was collected using a survey sample of a cross-section of 45 construction stakeholders in South Australia. 4 interviews were also conducted with stakeholders. Quantitative response data was subjected to descriptive analysis, whereas content analysis was used for the qualitative data.

Findings: The results suggest that the two fast track practices as applied affected project deliverables differently. Overlapping design with the construction stage was found affect the quality of the projects whereas 'acceleration' practices affected safety more than quality. Poor documentation was identified as one of the factors contributing to poor safety when applying 'overlapping' practice. The decision on whether to apply fast track practices was found to be dependent on the extent and type of construction projects.

Originality /value: This study has the value added potential of identifying areas of concern prior to site establishment and establishing measures for managing the additional works thereby raising the probability of project success relative to increased quality of construction, enhanced safety reduced cost of the project.

Keywords: Procurement, fast track projects, design and build contracts, project performance, survey, construction industry, South Australia

1. INTRODUCTION

The study is predominantly focussed upon the impacts of applying fast track practices to a construction project under a design and construct contract and the consequences incurred on project deliverables in particular cost, quality and safety requirements during the construction of a

project. Kasim *et al.* (2005) define the concept of fast-track system as the running of the design and construction processes of a construction project concurrently or simultaneously. Fast-track construction practices can take various forms such as '*acceleration*' and '*overlapping design*'. Acceleration is a head contractor focussed approach of increasing resources including night shift and tradesmen on-site at any particular time to finish sooner. The ultimate goal is to increase productivity, efficiency, and resources management thereby expediting the completion of construction projects.

Anecdotal evidence suggests that overlapping the design phase with the construction phase under design and construct contracts which are becoming increasingly popular within the South Australian construction industry reduce the duration of a project life cycle. The move towards such practices is being forced by a defined practical completion date or the belief of reduction in cost through decreased overhead expenses paid on duration commonly called preliminaries. Furthermore, despite the advocated benefits of applying such practices as highlighted in literature (Fazio *et al.* 1988a), the application is affected due to the incorrect assumptions made regarding the problem of applying fast tracking practices. For example, it is often said that the overall quality of a project is reduced, unsafe behaviour is more prevalent from the push-push nature of the project, and cost overruns are more common.

In order to encourage the application of such fast-track practices, there is a dire need of formally exploring or investigating the benefits through raising the awareness and consequences of applying fast track practices within the South Australian construction industry. This paper attempts to address this problem through highlighting potential consequences of fast tracking a project, and exploring how such practices affects project deliverables. The paper also identifies the main reasons for implementation of such fast-track practices by the construction stakeholders employing design-and build contracts. The paper commences with a brief review of 'fast-track' construction literature. This is followed by a discussion of the methodological approach adopted, and then presents the findings. Finally, the implications and conclusions are drawn in the last section.

2. LITERATURE REVIEW

An extensive literature review on the concepts of 'fast track construction' and 'design and construct' suggest that a lot has been written about them individually. However, there is limited literature which defines the concepts as integrated. This provides the basis for the provision of clearer definition of the concepts prior to any analysis or review of projects. Meyers (1981) defined both 'fast track construction' and 'design and construct' as processes. They have both been suggested as a means of accomplishing an end namely the completion of a particular construction project (Squires 1983). However, this loosely defines fast track construction but lacks some substance in regard to its difference to traditional build projects.

A somewhat more detailed description found in the literature review states that under a fast track approach the owner outlines for the architect the general criteria for the project. The architect then prepares, in varying degree of detail, basic design documents, schematic, heating, ventilation, ventilation and air conditioning, electrical preliminary structural drawings. From these incomplete drawings, the contractor estimates the cost of construction and then proceeds toward further firm negotiations or bidding (Meyers, 1981). From this basic definition, the inference is that construction progresses while design is in the process of being finalised, and this is where design overlaps construction thus minimising start time on site. Briefly stated, fast tracking compresses the project schedule by running design and construction phases simultaneously (Barbara, 2002).

Fast-track construction is based on the principles allowing early contractor involvement (ECI); therefore choosing a procurement method to facilitate this is essential. Generally occurs in the form of design and construct, however can be undertaken under many other procurement methods including Management Contracting, Alliance Contracting and even Partnership contracting. It is based on the principle of running the design simultaneously with the construction phase based on the presumption that the reduced life cycle of the project will significantly reduce final cost of the project. Project duration is compressed by overlapping work packages, but fast tracking further overlaps design and construction (Fazio et al. 1988). With this approach design work often ends up being done on a rushed basis. Inevitably accelerated drawings and specification are often prepared hurriedly, leaving room for a greater margin of errors and omissions (Fazio et al. 1988). These errors and omissions in documentation lead to many consequences on site, further investigation is recommended to explore whether these omissions impact the project deliverables stated in this research.

Design and construction practice of overlapping can shorten the project duration and reduce costs, as initially planned (Pena-Mora and Park, 2001). A study by Chan (1999) as cited in Chan and Chan (2004) found that most constructed project in Hong Kong as developed on fast track schedule, were completed within two to three years. Conversely, it can also delay the schedule and increase costs for various reasons. Whilst overlapping design and construction working in together simultaneously, errors and or omissions in design documentation take place, when these occur as the design is only slightly in front of the construction phase can lead to other issues often requiring re-work.. It has been suggested that increasing the overlapping degree between the design and construction created more changes in design and construction than those in the sequential method, which led to delays and counterbalancing the time reduction achieved by the increased overlapping (Pena-Mora and Park, 2001).

Meanwhile, there is another phenomenon found in the fast-tracked design work that is not necessarily found on the traditional method—everyone in the design process often makes allowances for unknowns to avoid possible impacts and changes (Tighe 1991). For instance in the early

stages of design where documentation is poor and time is critical several measures are taken to expedite the process such as making assumptions of items and often over sizing to ensure to decrease risk as there is no time to research and identify what exactly is required. This over sizing practice increases protection, but at the same time may cause a substantial increase in the project cost due to inefficient use of resources (Pena-Mora and Park, 2001). It was found that fast track construction is more suited to non specialised building types with a repetitive nature and standard construction, allowing for a momentum to build throughout the construction phase. Throughout the literature it was found that the reduced time spent on the completion of documentation severely affected rework on site stemming from construction issues. Often small design error or omissions when found are far more severe affect as implementing corrective action and increasing resources required.

3. RESEARCH METHODOLOGY

A questionnaire was developed to establish the reasons for implementing fast-tracking practices, and explore their impact on construction projects deliverables within the South Australian construction related organisations.

3.1 Instrument

The questionnaire was divided into five parts. The first part dealt with the general demographics of the respondents such as sector of organisation, length of experience, and exploration of fast tracking practices. The second part of the questionnaire was composed of four questions focussed on identifying the effect of applying over lapping techniques on the cost of the project. Section three dealt with the effect of fast track practices on safety as a project deliverable. The frequency of applying such practices was also sought. '*Overlapping design*' and '*acceleration techniques*' effect on quality of the construction projects was the basis of section four. Finally, the last section (five) dealt with the relationship between the 'quality of design' and associated project deliverables of time and budget. The type of questions sought ranged from open ended to those of seeking perceptions. The impact of the fast-tracking practices on projects deliverables such as cost, quality and safety were measured using a four-point scale as follows: 1 (never), 2 (not often), 3 (often), and 4 (always). The analysis mostly included descriptive statistics to depict the frequency distribution and central tendency of responses to fixed response questions.

3.2 Pilot Survey

To fit into the South Australian construction conditions, a pilot study was conducted. The professionals were asked to examine the questions, try answering them and make inputs. Piloting is necessary as it is very difficult to predict how respondents will interpret and react to questions (Gill and

Johnson 1991). Some very constructive suggestions and corrections were raised. The main area of ambiguity was that the majority of the questions related to fast-track practices as a broad term and no clear method or technique was defined. Furthermore, the respondents stated that the results of the questionnaire may differ depending on which fast-track practices were being implemented. As a result of the pilot study, the questionnaire was revised to specify whether it was the practice of '*overlapping design stage with the construction stage*' or application of '*acceleration techniques during construction*'. The revisions provided the participants with a clear focus and direction allowing them to make informed responses.

3.3 Survey Administration

The questionnaire was distributed using two methods, namely postal survey and electronic mail. The summary of the responses is shown in Table 3.1. As seen from Table 3.1, of the majority (70) of the questionnaires were sent out using the snowball technique in hard form to the stakeholders of a design and construct project in South Australia.

Table 3.1 Summary of survey responses

Method	Sent Out	Returned	Response Rate (%)
Post survey	70	40	57.14
Electronic	20	5	25.00
Sub Total	90	45	50.00

Forty questionnaires were received. These were submitted or returned to a questionnaire box located in the site office, thus a 57.14% postal response rate was achieved. On the other hand, of the twenty questionnaires which were sent electronically, only 5 were returned. The combined overall response rate was thus 50.0% (see Table 3.1). The high response rate demonstrates the effectiveness of the hard copy postal survey. The response rate was therefore deemed adequate for the purpose of data analysis. Akintoye and Fitzgerald (2000 cited in Odeyinka et al, 2008) argue that this is way above the norm of 20-30 percent response rate in most postal questionnaire of the construction industry. As observed by Sekaran (2003), one of the disadvantages of electronic questionnaires is that the respondents must be willing to complete the survey.

3.4 Interviews

In addition to the questionnaire, 4 face-to-face interviews were also conducted with various stakeholders of the construction industry. These were composed of a project manager, construction managers, programmers and a cost consultant. The purpose was to explore the benefits associated with implementing fast-tracking practices. The selection

was based upon their response to agree on having further discussion on the topic in the questionnaire survey.

3.5 Characteristics of respondents

The demographic characteristics of the respondents by sector of the organisation given in Table 3.2.

Table 3.2 Sector of respondents' organisation

Sector and role	Frequency	% response
Architectural and Engineering	10	22.2
Construction	13	28.9
Subcontractor	11	24.4
Cost Consultant	8	17.8
Others	3	6.7
Subtotal	45	100.0

As can be seen from Table 3.2, the majority (28.9%) of the respondents were drawn from the construction sector. This is followed by 11 (24.4%) Sub contractors. The 'others' were program managers and line manager. Nearly a quarter (22.2 per cent) of the respondents was from Architectural and Engineering sector, whereas the minority (6.7 per cent) that selected 'others' were mostly programmers and draughtsmen. The results also achieved the intentions of the study as the question related to the sector and role was aimed at dividing the construction industry into segments; these [segments] were created to understand different perceptions among the various professionals in the construction industry who are the major stakeholders of a construction project obviously excluding the client. Table 3.3 presents information on the respondent's length of experience in the construction industry.

Table 3.3 Construction industry experience

Range (no. of years)	Frequency	% response
1 - 5	6	13.33
5 -10	16	35.56
10 -15	12	26.67
More than 15	11	24.44
Subtotal	45	100.0

As can be seen from Table 3.3, the respondents surveyed did have a wide range of experience in the construction industry. More than 86 percent of the respondents had more 5 years of experience. This indicates that the data gathered has some substance behind it as the majority of the respondents had previously worked on construction projects that utilises the fast tract construction practices. Furthermore, it enhances the validity of the data as collected. To ascertain the length of experience of the respondents with the sectors in which they operated, a cross tabulation was conducted. Table 3.4 presents the summary of the length of experience * sector tabulation.

Table 3.4 Construction industry experience * sector

LECI	(years)/	A & E	C	CC	SC	O	Total
-------------	-----------------	------------------	----------	-----------	-----------	----------	--------------

Sector						
1 - 5	1	4	0	1	0	6
5 -10	5	2	5	3	1	16
10 -15	4	3	3	1	1	12
More than 15	0	4	0	6	1	11
Subtotal	10	13	8	11	3	45

Notes: A & E = Architectural and Engineering; C = Construction; CC = Cost Consultants; SC = Sub-Contractor; O = Others; LECI = Length of Experience in Construction Industry

As can be seen from Table 3.4, the sector of the industry surveyed with the most experience was sub-contractors with 6 respondents having more than 15 years of experience. In second place were respondents drawn from construction organisations with almost a third (31%) of its respondents falling into the 'more than 15 years' of experience category. This finding confirms richness of the data as it will aid in accurate responses to questions where on-site experience is necessary including safety and quality in construction issues associated with applying fast-track practices.

4. ANALYSIS OF DATA & DISCUSSIONS

The following sub section presents the analysis of data and discussions on the perception of the construction stakeholders relative to whether overlapping the design stage with the construction stage had adverse outcomes on project deliverables of cost, quality and safety.

4.1 Impact of overlapping the design stage with the construction stage

Table 4.1 summarises the frequency of response to the effect of overlapping on project deliverables.

Table 4.1 Effect of overlapping

Type of effect	Frequency	% response
Always	16	35.56
Often	20	44.44
Not Often	9	20.00
Never	0	0.00
Subtotal	45	100.0

The following question was posed: How often do you believe overlapping design with construction leads to adverse outcomes on project deliverable such as; cost, quality and safety? As can be seen from Table 4.1, it is quite visible that the industry perception is poor with 80% (36) of respondents stating overlapping design with construction had adverse effects. Similar sentiments were identified from the interview process with some respondents acknowledging that most negatively affected areas in fact impacted on other project deliverables such as cost, quality and safety. In particular, it was suggested that poor design documentation had a ripple

effect extending to the majority of project deliverables being reviewed. This finding somehow contradicts the view of one Project Manager who noted the following benefits:

Fast tracked projects are a good idea if the contract is typically Design and Construct (D&C) and construction starts on 85% or higher documentation. If this is done then construction will fly as long as good contractors are available and money is spent to accelerate construction via technology proper planning and adequately resourced project. Also need right contractors with good relationships with subcontractors and suppliers. - Project Manager

The above suggestion implies that other factors such as 'good relationships', 'proper planning' and 'availability of resources such as money and time' need to be taken into consideration in order to achieve the benefits of fast-tracking practices. To ascertain the breakdown of respondents who responded 'always' and 'often', cross tabulation was conducted and the Table 4.2 presents a summary according to the construction sector.

Table 4.2 Participant breakdown of respondents

Sector / Role	Frequency	% response
Architectural and Engineering	8	22.22
Cost Consultant	5	13.89
Construction	12	33.33
Sub contractor	9	25.00
Other	2	5.56
Subtotal	36	100.0

As can be seen from Table 4.2, the majority (21 out of 36) 58.33% of the respondents were drawn from construction and sub-contracting organisations as they are more likely to deal with the effect of overlapping the design stage with the construction stage.

4.1.1 Impact of overlapping design with construction on Project deliverables

Table 4.3 present a summary of the area's most negatively affected by overlapping design with construction. The respondents were asked to rank on a four-point scale (Negatively Affected = '1', and Least Affected = '4'), the areas they believed to be most negatively affected by overlapping design with construction.

Table 4.3 Participant breakdown of respondents

Project Deliverable	Frequency	% response	Ranking
Design Documentation	19	42.22	1
Project Quality	13	28.89	2
Construction Cost	11	24.44	3
Safety	4	4.45	4
Subtotal	45	100.0	

As can be seen from Table 4.3, 'Design Documentation' was the most ranked as resulting from overlapping design with construction. This can be attributed to the on-site rectification of design issues.

4.2. Effect on Cost

Figure 4.1 summarises the responses regarding the impact of fast-track practices on the reducing the overall project cost. As can be seen from Figure 4.1, the majority (60%) of the respondents agreed that overlapping design stage with the construction stage reduced the overall project cost. On the other hand, 57.78% stated that acceleration, through increasing resources and productivity did not lead to an overall reduction of the project cost.

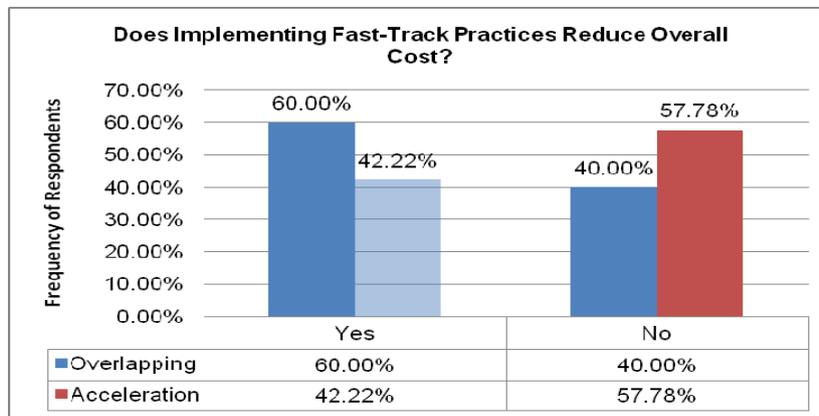


Figure 4.1 – Does Implementing Fast-Track Practices Reduce Overall Cost?

This was further supplemented by information from the interviews which indicated that acceleration could sometimes be utilised not to reduce the cost, but to enable the completion of a project which sometimes forced by an inflexible date, where project completion was not negotiable. One such example provides was the construction of a stadium being purpose built for an event where the date is fixed (i.e. World Cup or Olympics stadia). This suggests that acceleration might be required to ensure the project meets programme and is delivered in time. This finding suggests that separating the two fast track practices and identifying the relationship each has on negatively affecting the project cost, where overlapping design is seen to reduce cost is being supported by the literature and interviewees where acceleration techniques seem to increase cost as the survey data was analysed.

4.2.1 Lack of information and Increased Construction Cost

Table 4.4 summarises the frequency of response to the effect of lack of information on construction costs through over engineering. The following question was posed: How often do you believe that assumption made during design from lack of information leads to increased construction cost through over engineering?

Table 4.4 Impact of Information on Increased Construction Costs

Frequency of belief	Frequency	% response
Always	9	20.00
Often	23	51.11
Not Often	11	24.44
Never	0	4.45
Subtotal	45	100.0

Analysis of these results indicates that almost 71% of the respondents found that overlapping the design stage with the construction stage leads to over engineered structures.

4.3 Effect on Design Documentation

Table 4.5 summarises the effect of fast-tracking practices on design. The respondents were asked on a four-point scale (Strongly Disagree = '1', Disagree = '2', Agree = '3', and Strongly Agree = '4'), the extent to which the quality of design affect a project's capability to be delivered in time and within budget, and to an acceptable level of quality.

Table 4.5 Influence of the Quality of Design Documentation

Levels of Agreement	Frequency	% response
Strongly Agree	26	57.78
Agree	11	24.44
Disagree	7	15.56
Strongly Disagree	1	2.22
Subtotal	45	100.0

Analysis of these results indicates that almost 84% of the respondents found either agreed or strongly agreed that the quality of design will contribute to the success.

4.3.1 Impact of 'Overlapping' and 'Acceleration' on Project Quality

Table 4.6 summarises the frequency of response to the effect of fast-track practices on the quality of the project. The following question was posed: How often do you believe that applying fast-track techniques leads to reductions in the quality of the project?

Table 4.6 Impact of 'Overlapping' and 'Acceleration' on Project Quality

Frequency	Overlapping		Acceleration	
	Frequency	% response	Frequency	% response
Always	8	17.78	4	8.89
Often	23	51.11	31	68.89
Not Often	12	26.67	8	17.78
Never	2	4.44	2	4.44
Subtotal	45	100.0	45	100.0

Analysis of these result indicates that the majority of the respondents believe that applying acceleration practices as a fast-track technique affects the quality of construction project more so than that of 'overlapping design with construction'. This finding was complemented by the interviews in which several interviewees stated that acceleration can have higher adverse effects on project quality. The argument put forward was that increased resources and the push on the project including night shifts and additional tradesmen on-site at any time could lead to short cuts being taken. Some other views were also expressed. For example, a project manager with substantial fast-track experience observed that quality can severely be dependent on the construction firm delivering the project, with the appropriate experience, and lessons learnt from previous projects, this reduction in quality could be minimised with strong emphasis on quality assurance practices throughout the construction stage mitigating the risk. This was to some extent dependent on the provision of additional resources such as supervision and quality managers to control acceleration practices, where traditionally, these roles are not often as strongly encompassed where fast-track construction does not exist.

4.3.2 Impact of Time on Practical Completion

Table 4.7 summarises the effect of reducing time frame on the practical completion date.

Table 4.7 Influence of the Time Frame on Practical Completion

Influence	Frequency	% response
Yes	9	20.00
No	15	33.33
Maybe	21	46.67
Subtotal	45	100.0

The respondents were asked to select from any of the following three options: 'Yes', 'No', and 'Maybe', as to whether reducing the time frame to complete the design of a project always successfully resulted in reducing the practical completion date.

Nearly a third of those surveyed did not perceive overlapping design with construction as truly expediting completion of the construction project. This result contradicts with those obtained from the Interviews. For instance, a Construction Manager advised that significant benefits such as reductions in the programme can be obtained in the reduction of practical completion through application of fast-tracking practices such as overlapping design with construction. Interestingly, only a minority (20%) of the respondents thought that it was possible whereas the majority (46.67%) possibly thought it was feasible to achieve a reduction of the practical completion date through overlapping.

4.4 Effect on Safety

The following question was posed: How often do you believe that safety key performance indicators (KPI's) including lost time incidents (LTI's), near

misses etc. are higher on projects where acceleration practices are implemented? The respondents had the following two options: 'Yes' or 'No'. The results suggest that overlapping the design with construction does not in fact adversely affect safety, with approximately 64.44% of the participants responding 'no'. On the contrary, this is different with the results regarding acceleration practices where the majority (62.22%) of the respondents believed that accelerating practices adversely affected safety during construction. As highlighted by Chan and Chan (2004), safety is one of the performance criteria of a construction project. Table 4.8 (see Appendix A) summarises the general comments regarding the application of fast-track practices as made by the respondents.

5. CONCLUSIONS & IMPLICATIONS

This study investigated the reasons for implementing fast-tracking practices, and explored their impact on construction projects deliverables. It was established that fast-tracking construction practices such as acceleration and over-lapping design contribute to project effectiveness. Despite the growing importance of such practices, the awareness and consequences of applying fast track practices have not been formally explored or investigated. The principal conclusions to be drawn from the study are as follows:

- The two fast track practices as applied affected project deliverables differently.
- Overlapping design with the construction stage was found affect the quality of the projects whereas 'acceleration' practices affected safety more than quality. Poor documentation was identified as one of the factors contributing to poor safety when applying 'overlapping' practice.
- The decision on whether to apply fast track practices was found to be dependent on the extent and type of construction projects.

It is further recommended that implementing any type of fast-track practices that resources and procedures are implemented to manage the increased pressure on the construction project. If these are not established early in the construction project may leave the project at risk of increased un-forecasted cost over-runs, delays and re-work leading to reduced quality of the construction project as a whole.

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phase' on which R. Nassereddine and N. Chileshe carried out further analysis. The dissertation was submitted to the School of Natural and Built Environments, University of South Australia, Australia

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Appendix A - Table 4.8 Respondents General Comments on Fast Tracking Practices

No.	Comments
A	Fast track practices work when the builder has a good relationship with the client. If there is an understanding of documentation (i.e. 70% documentation) it can work well. The site team needs to get together, and this process works well with good program, request for information (RFI) system, and site coordination. With an A-Grade team fast track is enjoyable and rewarding for all involved. Anyone on the team that isn't committed will cause a glitch in the team, and it may fail. - Site Manager
B	By incorporating subcontractors in the design phase you can improve productivity and quality - Project Manager-1
C	Design changes during construction, for example architectural type, effect services and rarely reviewed. - Services Manager
D	The clients driving factors need to be considered to improve one area such as cost, another area such as time will need to suffer - Project Manager-2
E	Fast tracked projects are a good idea if the contract is typically Design and Construct (D&C) and construction starts on 85% or higher documentation. If this is done then construction will fly as long as good contractors are available and money is spent to accelerate construction via technology proper planning and adequately resourced project. Also need right contractors with good relationships with subcontractors and suppliers. - Project Manager-3
F	I find accelerating a project with additional shifts can sometimes (due to communication between supervision) be detrimental in time taken to complete tasks. - Site Manager
G	I completed a time versus cost assessment on two identical buildings comparing Building 1 to Building 2, actual statistics showed that we spent an extra 30% more on Building 1 implementing acceleration techniques and it took 10% longer (structural trades only) - Contract Administrator-1
H	Acceleration can be beneficial if costed correctly and the builder will be reimbursed appropriately – then corners (i.e. safety / quality) will not be cut. - Contract Administrator-2
I	Should only be carried out if practical to do so and should in no way affect safe work practices, or quality of installation - Sub-Contractor
J	Having a 100% design in the BIM form will provide exact cost as builders can price what is required. Risk is minimal for all parties, taking a design at 30% to 50%. However clients have a pressing need for the project's completion – i.e. must be complete for Christmas shopping, South Australian Cricket Association (SACA) opening before cricket test, so program dictates the time.

	Politicians, Clients, make promises that the project will be completed to the client, for example banks, public. Knowing the construction period – plan ahead and you do not need to panic - Programmer
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ASOCSA2011-28

The Practice of Out-sourcing in the Management of Office Building/Facilities in Lagos-Nigeria

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ABSTRACT

Purpose

This study examines the nature and scope of out-sourcing of various scope of work by Office building / facilities support service providers in Lagos-Nigeria.

Design / methodology / approach

The research adopted quantitative survey method using questionnaires as the data gathering instrument. The data obtained was analysed with descriptive statistics such as percentages, frequencies and mean. Inferential statistics such as one way Analysis of Variance (ANOVA) and Chi-square were used to test the hypotheses that were formulated for the research.

Findings

Total outsourcing is currently not practiced in Nigeria. Building support service providers in Nigeria adopt different levels or extents of outsourcing, but medium level outsourcing is most common. None of the three levels of outsourcing is significantly more effective than the others. More labour intensive and less specialized activities are more frequently outsourced by the respondents, while the more strategic and specialised responsibilities which are imperative for the achievement of organizational objectives and image of the organization are retained in-house.

Research Limitations

Although respondents were chosen randomly, the building sample were purposively chosen to include only purpose built office buildings with well established support service provision

Practical implications and Contribution to development

The survey provides information that can enhance the success of outsourcing of tasks by the building support service provider. It indicates areas of the market that are available for out-tasking to service companies. It also indicate that model or extent of outsourcing is not a determinant of success in outsourcing of building support service

Original / value of paper

It fills important research gaps on nature and scope of outsourcing and effectiveness of levels (models) of outsourcing of building support service in Lagos, Nigeria.

KEYWORDS: Building support service, Efficiency of support service, Office buildings, Outsourcing

1. INTRODUCTION

Outsourcing involves transferring the management of non-core functions or the out-tasking of these activities to external providers. Arnold (2008) described outsourcing as an abbreviation of the phrase “outside resources using”, while Slepniou and Waehrens (2008) referred to it as a switch from use of internal to external resources in conducting activities. Extreme proponents of outsourcing believe that non-core services including management of buildings and facilities should be outsourced. One of the popular reasons for this proposition is the belief that managers of non-core services cannot aspire to become top level managers within an organization. However, as owners of their own management outfit they can be spurred to high performance and productivity. Williams (2003), Elmuti (2003), Burns (2008) and Hesketh (2008) admit that in most cases outsourcing of Facilities Management Departments have been identified with real cost savings. They identified some other reasons for outsourcing as quality, motivation, flexibility and availability of enhanced skills.

William (2003) identifies two generic types or models of outsourcing; firstly that which involves outsourcing of (management) supervision and direction of task operators and facility services and secondly, that which involves contracting out of Facilities management activities or tasks otherwise known as out-tasking. Another dimension to outsourcing (a more extreme one) is where the space need of an establishment is met by leasing pre-serviced buildings from a facilities management consortium. This involves the total devolution of all support service provisions to FM companies that will provide both delivery and management of FM functions (Fielder, 2003).

According to Jones (2000) flexible service occupancy enables organisations to dissociate themselves from the volatility and constraints of property investments while creating space flexibility and quality. It also replaces the separate payments for land, rents, rates, property management and support service with a single charge for a serviced environment. In other words, this arrangement creates better value for money in all ramifications. Other financial advantages that pre-fitted / serviced accommodation arrangement offer to businesses are significant reduction in the capital outlay that will ordinarily be required to commence operations and the retention of greater volume of business turnover as profits; a direct consequence of not having the need to provide for depreciation on wasting assets as is usually done with company fixed assets accounts (Bottom 2003). With pre-fitted / serviced accommodation small scale companies may be able to obtain quality, comfortable and effective FM with minimal expenditure, a situation which invariably enhances growth, sustainability and continuity.

Many FM practitioners agree with most of the positive outcomes of total outsourcing as identified above. For these reasons, this type of outsourcing is being advocated by authors such as Jones (2000). In spite of the identified advantages of total outsourcing some writers such as Williams (2003) and Burns (2008) advocates rather, medium level outsourcing where specialist engineering and strategic functions are retained in-house while highly labour intensive activities like cleaning and security are out-tasks. However Williams (2003) as other authors like Hesketh (2008); Slepnirov and Waehrens (2008); Paxman (2005) and Lacity, Willocks and Rottman (2008) observes that the major determinant of success in outsourcing in management of building and facilities is not the level or model adopted but rather the extent to which the objectives of the organization for outsourcing are well identified and the strategies to be adopted are outlined.

Although the numerous advantages of outsourcing as examined above relates to total outsourcing, however, literature such as Burns, (2008); Hesketh (2008) and Elmuti (2003), indicate that generally most forms of outsourcing offer some of the identified advantages, although to varying degrees. This suggests that outsourcing in whatever form saves cost and improves performance of buildings and its support services, and that the success of the support service provisions in a building could be different at different levels of outsourcing. In the attempt to enjoy these possible advantages the decision to allocate building support task in-house or out-house has become a paramount one for executives of organizations (Springer, 2001). There is also the decision as to what extent of outsourcing is i.e. low, medium or total could be more effective and should be adopted.

The above issues makes researches such as the current one which examines the possible contribution of outsourcing to the enhancement of work space performance at various levels pertinent, particularly in the Nigerian context. The research is also important in that it identifies frequently outsourced task or activities within the market in order to provide this information for companies who provide building support services. For this reason the aim of this research is to examine the nature and scope of outsourcing of building support services within the Nigerian office building sector and to identify any possible relationship between the level or extent of outsourcing and performance of the concerned

building/facilities. In other words, this research established if performance of building and services increased with higher level outsourcing in the Nigerian context. This aim is achieved through the following specific objectives.

- Establishing the prevalence of the different level of outsourcing i.e. low, medium and high and total in office building / facility support service provision. In other words the extent of outsourcing of FM roles or tasks and
- Determining if any of the outsourcing levels is more efficient than others
- Determining the most frequently out-sourced roles in office building/facility support service provision

Expectedly, the study will fill important research gaps by providing information on the practice of outsourcing of building support in Nigeria and invariably enhance the quality of management of fixed assets owned or used by establishments. It will also indicate the areas of the market that are available for out-tasking to service companies, by identifying most frequently outsourced building support service activities among Nigerian organization.

2. LITERATURE REVIEW

Frequently Outsourced activities and Tasks

According to previous studies, top activities or functions that are usually outsourced are information technology (contract programming, data entry and simple data processing), management services and manufacturing of products or services (Elmuiti, 2003; Corbett, 1999; Bender, 1999). Organisations have transferred responsibility for entire functions such as human resources, finance, information technology, and research and development services to both local and offshore service providers. Other outsourced activities according to Austin et al (2001) are purchasing, invoicing, billing, postal services, real estate, FM and administration tasks. Brown (2005) cited in Kostin 2009 identified ten major areas of outsourcing as information technology, administration, human resources, Finance, Sales and marketing, transport, distribution and logistics, real estate and FM, manufacturing and contact centers. Out of these (ten) 10 areas, real estate and FM was placed ninth in terms of frequency of application. In spite of this indication, outsourcing in FM fast gaining grounds.

According to Atkinson (2006), outsourcing in FM has basically been targeted at cost savings but this gradually shifted to quality of service. Barret and Baldry (2003); Siervert (1998) and Williams (2000) identified some commonly outsourced activities in FM as, electrical/mechanical services, fabric maintenance, internal planting and landscaping, security, cleaning, catering, vending, supply of receptionist, mailroom, finishes maintenance, external areas, property asset management, estate management, janitorial services, building operations and office support. Additional areas of outsourcing in FM according to Paxman (2005) are kitchen equipment, general cleaning, confidential wastes, feminine hygiene, porter service, travel and fleet management.

Key Success Factors for Outsourcing

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Literature provides that it is near impossible to have either a hundred percent outsourcing or in house provision. Sievert (1998) disagrees with total outsourcing and recommended that some activities should never be outsourced. He gave the example of maintenance of a nuclear weapons manufacturing plant which should never be outsourced due to insecurity issues and major production equipment or system in a manufacturing company. Williams (2003) also advised against commercial contracting or flexible occupancy agreement because according to him, it sometimes leads to the employer losing control of the cost and quality of the services provided. He also explained that there are always unscheduled inevitable works, contractual claims and conflict of interest issues that result in problems. Paxman (2005) identified some activities that are usually not outsourced in FM as, property management, space planning, audio visual equipment, telecommunication and senior management. It however appears that success in the outsourcing of task or services is not a function of the model adopted by the organization or what task is outsourced. This is supported by Slepnirov and Waehrens (2008) in their observation that evidence does not support a one size fits all path or process to the success of outsourcing and that the processes of outsourcing are not surprise free. They stated further that for outsourcing to be successful, companies have to learn about their own historically generated interdependencies which make it difficult to lift one element from a complex system.

Researchers have come up with important success factors to assist executives of organization in their outsourcing decisions. A major one among these factors is the need to identify appropriately the objectives and expectations of outsourcing to the concerned organization {Williams (2003); Elmuti (2003); Hesketh (2008); Slepnirov and Waehrens (2008)}. In the case of building support services or FM, it is equally important to possess the ability to incorporate the identified objectives into the FM process. Lacity et al. (2008) explained that for outsourcing to be successful both clients and suppliers must diligently manage the details. The writers gave additional key success factors for outsourcing as follows; client readiness, good strategy, rigorous processes, sound contract and good relationship management, adequate planning during phases of outsourcing and effective organizational communication.

It is not in all instances that at least the minimal positive expectations of outsourcing are met. Sometimes the nature of activity that is outsourced and the extent of positive expectations make in-house providers outperform the outsourcers. This was the case in Beimborn et al. (2006) where in the aspects of alignment and flexibility of IT with business strategy within German banking industry in-sourcing was found to outperform outsourcing. Kostin (2009) also found that despite the similarities between Russia and Sweden in terms of geographical location, culture and nature, there are marked differences in the models, extents and even impact of outsourcing between woodworking companies operating in both countries. These are good reasons for continuing researches into different outsourcing activities within various environmental contexts. A number of research have been done on outsourcing of logistics, supplies and transportation, information technology, Health and human resources management (Beinstock (1994); Ahola (2008); Beimborn et al. (2006); Aktas and Ulengin (2005) Siddiqi, Masud, & Sabri (2006); Burns (2008) and Busi and Mclvor (2008). However, Studies on Outsourcing of building

support service provision particularly within the context of a developing world have been limited. This creates an important research gap which this current research attempts to fill.

3. METHOD OF RESEARCH

Sampling and data collection

This research adopted quantitative survey method. The survey was conducted among occupants of office buildings within Lagos metropolis. Primary data were obtained through questionnaires that were sent to respondents within the sample. The sampling was multi-staged; accordingly, the sampling was done first among buildings and then among respondents in the buildings. The buildings were chosen purposively to include only purpose built offices that have well established building support provisions. On this basis, 41 buildings were included in the sample. The respondents for the study are in two categories i.e. the users of the building and the support service providers for the buildings. Two (2) respondents were randomly chosen within the building support service department of each building and six (6) respondents among the users of each building. This translates to 82 respondents among the building support service providers and 246 among the users. A different type of questionnaire was sent to each group. In all 307 questionnaires were sent out for this study. Out of this, 54 questionnaires were duly filled and returned by the support providers and 150 for the users. This translates to a response rate of about 66% and 61% respectively.

Data on outsourcing was obtained from the building support providers, while the one on performance of the buildings was obtained through the user's questionnaire. Twenty four (24) outsourcing tasks that were obtained from previous literature were examined in the study. Building performance was measured using 28 satisfaction and 17 comfort factors. Some of the satisfaction factors that were used in the measurement are adequacy of electric power supply, adequacy of signage and direction displays, level of hygiene, level of safety and security, adequacy of office space, efficiency of waste management and adequacy of personal space, while the comfort ones include, flexibility and comfort of furniture, adequacy of natural ventilation, adequacy of lighting, temperature comfort, comfort and cleanliness of sanitary provisions.

Method of Analysis

Frequency and percentages were used in establishing the level of outsourcing of FM tasks among the support service providers. The level of outsourcing was divided into 4 categories of 1-19%, 20-59%, 60-99% and 100% representing low, medium, high and total level outsourcing respectively. None of the support providers practice total outsourcing; our analysis was therefore reduced to the first three categories of low, medium and high levels. Chi-square was used to test the significance of the difference in the levels of outsourcing within the three categories. Data on performance of the sampled building were required in order to determine the possible difference in efficiency for the three outsourcing levels. Performance was rated on a Likert scale of 0 to 5. 0 represent not provided, 1 is not satisfactory, 2 is somewhat satisfactory, 3 is less satisfactory, 4 is satisfactory and 5 is very satisfactory. The mean performance score is

obtained for each building, the mean values for the buildings in each level are then summed up to obtain the total performance score for each category. One way analysis of variance (ANOVA) is then deployed to determine the difference in the efficiency level of the three categories. This is done at 95% confidence level.

To determine most frequently outsourced task, again Likert scale of 0 to 4 was adopted. 0 representing never at all, 1 is hardly ever outsourced, 2 is fairly often outsourced, 3 is very frequently outsourced and 4 representing outsourced all of the time. The mean value of the ratings for each variable or item is then obtained. These mean values are then ranked from 1 to 24th.

4. RESULT

Characteristics of respondents

The average age of respondents among the service provider is 41.17 years. Three of them had OND (ordinary national diploma) academic qualification, while 34 have B.sc / M.sc degrees, 17 others have post graduate diplomas or certificate. The average age among the building occupants is 38.56 years. Fifteen of this group of respondents are OND certificate holders, 83 have HND / B.sc degrees, while 42 have M.sc and other higher degrees. This indicates about 94% and 83% of the respondents in the service providers and users' category respectively have at least a B.sc qualification. This shows that our respondents are educated well enough to be able to provide appropriate responses to the questions asked.

Although the building support service profession is a male dominated one about 18.5% of the respondents are women. There is an even better spread in the users' respondents as almost 37% are women. This implies that the views of both sexes are fairly well represented in the sample.

Level of Outsourcing

The frequency of respondents who outsource tasks at the four different levels of outsourcing can be found in Table 1. As stated earlier none of the respondents practiced total outsourcing. This table indicates that 22 out of the 58 support providers representing 40.7% practice low level outsourcing. Twenty four of the respondents representing 44.4% practice medium level outsourcing, while eight (8) respondents representing 14.8% practice high level outsourcing.

Table 28. 1: Level of Outsourcing

Level	Frequency	Percentage
Low	22	40.7
Medium	24	44.4
High	8	14.8
Total	0	0

Source: Field study (2011)

This implies that Total FM (TFM) or Total outsourcing is currently not practiced in Nigeria. This suggests that Nigerian building support service providers abstain from practicing TFM. This is consistent with the recommendation by authors such as Sievert (1998), Williams (2003) and Paxman (2005) that TFM apart from being impractical should be avoided. It is also implied that medium level outsourcing is most practiced among building support service providers in Nigeria i.e. medium level outsourcing is the commonest level of outsourcing. This is followed by low level outsourcing, while the least common is high level outsourcing.

Table 28. 2: Chi-square test for significant difference in level of outsourcing

	Main Focus
Z	8.444
Degree of freedom	2
Asymp. Sig. (2-tailed)	0.015

Source: Field study (2011)

Hypothesis 1

Chi-square was used to test the hypothesis that;

H₀: Nigerian building support service providers do not adopt different levels of outsourcing and

H₁: Nigerian building support service providers adopt different levels of outsourcing

Table 2 indicates the result of this test at 95% significant level and 2 degree of freedom. The test shows Z value as 8.444 and p value of 0.015 < 0.05. As p value is less than 0.05 the null hypothesis *H₀: that Nigerian building support service providers do not adopt different levels of outsourcing was therefore rejected and the alternative hypothesis H₁: that Nigerian building support service providers adopt different levels of outsourcing was therefore accepted*

In other words there is a significant difference in the number of service providers practicing at each of the levels shown in Table 1.

The more efficient level of Outsourcing

The level of performance of the sampled building were calculated in order to determine if any of the three level is more efficient than the others and which one. The level of outsourcing with the higher building performance scores is expected to be the more efficient level. The efficiency values that is total performance scores for the levels are; (175.049) for low, (172.321) for medium and (172.323) for high level outsourcing. This means that low level outsourcing is indicate to have the highest level of efficiency followed by high level efficiency and lastly medium level outsourcing.

Hypothesis 2

One way ANOVA was deployed to test the second hypothesis that

H_0 : There is no significant difference in the efficiency of different levels of outsourcing of FM tasks among Nigerian building support service providers and

H_1 : There is a significant difference in the efficiency of different levels of outsourcing of FM tasks among Nigerian building support service providers.

According to the results indicated in Table 3, the performance scores for the levels of outsourcing are low (175.049), medium (172.321) and high (172.323). The figures in parenthesis are the performance scores for the buildings that are comprised in each of the different levels of outsourcing. $F_{(2,30)} = 0.044$ and $p = 0.957$. The rule at 95% confidence level is "reject null hypothesis if observed p is equal to or less than p value of significance of 0.05". With an observed p value of $0.957 > 0.05$, the null hypothesis could not be rejected as the evidence does not support a rejection. This implies that at 95% confidence interval the null hypothesis that "there is no significant difference in the efficiency of the different levels of outsourcing" is not rejected and that the difference in the three performance scores {(175.049), medium (172.321) and high (172.323)} is only as a result of random variation.

Table 28. 3: One Way Analysis of Variance for Significant Difference in the Level of Outsourcing Efficiency

	Sum of Squares	df	Mean Square	F-ratio	Sig.
Between Groups	59.972	2	29.986	0.044	0.957
Within Groups	20229.600	30	674.320		
Total	20289.572	32			

Source: Field study (2011)

Ranking of the frequency of Outsourcing of Various Building Support Service Tasks

To identify the most frequently outsourced FM tasks in Nigeria the 25 tasks that were identified from literatures respondents were requested to rate the tasks on a likert scale depending on their perceived frequency of outsourcing. Details of the scales and method of analysis have been discussed under methodology. The mean score for each task or variable was then determined and subsequently ranked to establish the position of the tasks in terms of frequency of outsourcing. Table 4 provides the details of the findings.

Table 28. 4: Ranking of Tasks According to Frequency of Outsourcing

Outsourced Tasks	Mean	Ranking
Security management	3.17	1

Cleaning and sanitation	3.16	2
Outdoor and environment maintenance	3.04	3
Janitorial services	3.00	4
Pest control	2.93	5
Other waste management	2.88	6
Building fabric maintenance	2.87	7
Landscaping	2.85	8
Building safety	2.78	9
Catering and vending	2.73	10
Mechanical, equipment and electrical related maintenance	2.64	11
Staff health management	2.54	12
Confidential waste management	2.50	13
Travel services and fleet management	2.40	14
Audio visual equipment provision and mgt	2.39	15
Internal/external portering and mail services	2.37	16
Landed property leasing, procurement and disposal	2.31	17
Facility and building design	2.29	18
Information and computer technology mgt	2.25	19
Management level responsibilities	2.18	20
Purchasing and procurement	2.16	21
Reprographics and stationery	2.07	22
Reception	2.05	23
Transportation and parking	2.04	24

Source: Field study (2011)

The table is arranged from 1 (one) to 25 according to the ranking of the frequency of outsourcing of the tasks from the FM practitioner's perspectives. According to the study, Security management was ranked 1st as the most frequently outsourced activity. Cleaning and sanitation was ranked next at 2nd position, Outdoor and environment maintenance was 3rd, Janitorial services 4th, Pest control 5th and other wastes management 6th in that order (see Table 4).

The implication from this finding is that the more labour intensive less specialized activities are more frequently outsourced by the respondents. This conforms to the recommendation by authors such as Austin et al (2001); Williams (2003); Paxman (2005) and Burns (2008) that specialist engineering FM functions should be retained in-house while highly labour intensive activities like cleaning, janitorial and security activities should be out-tasked.

The five (5) least frequently outsourced service according to the respondents are transport and parking ranked 24th, reception ranked 23rd, reprographics and stationary ranked 22nd, procurement ranked, 21st and management level responsibilities ranked 20th. This result implies that the more strategic and specialised responsibilities are being retained in-house as these set of responsibilities are cogent for the achievement of organizational objectives and image of the organization. This is in line with the recommendation by Paxman (2005) that it is better to retain tasks such as lease management, space planning and relocation, audio visual equipment, telecommunication, senior management responsibilities and reception in-house. Similar recommendations were also made by authors such as Williams (2003) and Burns (2008).

5. CONCLUSIONS AND RECOMMENDATION

Some of the major conclusions is that the nature and scope of outsourcing of building support services or FM in Lagos, Nigeria is not so different from what obtains in most part of the world and as recommended by previous authors. For instance this study indicates that Total FM (TFM) or Total outsourcing is currently not practiced in Nigeria. A number of earlier works similarly advised on total outsourcing. It was also indicated that the Nigerian building support service providers adopt different levels of outsourcing and that medium level outsourcing is the commonest level of outsourcing, followed by low level outsourcing, and then high level outsourcing, although it is indicated that none of these three levels of outsourcing is significantly more efficient than the others. This finding implies that the level of outsourcing is not an important success factor in the outsourcing of building support services and that rather successful outsourcing may be dependent on how appropriately the objectives and expectations of outsourcing to the concerned organization are identified and planned for.

On the frequency of outsourcing of the various FM tasks it can be concluded that more labour intensive and less specialized activities such as, Security management, Cleaning and sanitation, Outdoor and environment maintenance and Janitorial services are more frequently outsourced by the respondents. It is also indicated that the more strategic and specialised responsibilities such as management level responsibilities, reception and procurement which are imperative for the achievement of organizational objectives and image of the organization are being retained in-house by the Nigerian building support service providers. This conforms to the recommendation in previous researches such as, Austin et al (2001); Williams (2003); Paxman (2005) and Burns (2008).

It is recommended that to be successful at outsourcing, the Nigerian building support service providers must look beyond the extent or model of outsourcing that they are adopting but rather they must sufficiently identify their organizational objectives for outsourcing and consolidate their strategies on how these objectives will be applied in the outsourcing of FM tasks. It is also recommended that a good strategy for success is to outsource more frequently, the labour intensive and less specialized activities while retaining in-house, the more strategic and specialized ones.

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Comments from the Property Industry on Masters Real Estate Curricula in South Africa

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ABSTRACT

Purpose: The aim of this paper is to report comments given in a survey of property professionals in the industry on Masters Real Estate (MRE) curricula in South Africa.

Methodology: A questionnaire was administered to obtain comments from property professionals in the industry on MRE curricula in South Africa.

Findings: The property industry survey revealed that MRE curricula in South Africa have both strengths and weaknesses. The main strength of the curricula noted by the property professionals is that the curricula are interdisciplinary. Weaknesses reported include lack of case studies and practical components in the curricula.

Research limitations: Results of the survey will not directly influence change to the processes of curriculum development for postgraduate real estate education in South Africa. Curricula development will largely depend on outcomes of discussions of lecturing staff and university administrations implementing the courses.

Value: The study will support processes of curricula improvement for MRE programmes in South Africa

Keywords: Masters Real Estate curricula, property industry

1. INTRODUCTION

MRE curricula taught by coursework which are offered in South Africa are given in Table 1. As part of the process of assessment of these curricula, property professionals in the industry were asked to give comments on the curricula. Justification for the survey is based on the fact that postgraduate real estate curricula in South Africa were developed without conducting more detailed property industry surveys to determine curriculum requirements (Cloete, 2002; Chikafalimani and Cloete, 2007; and Chikafalimani and Cloete, 2010). In addition, practitioners in the industry have an important role to play in the processes of real estate curriculum improvement (Gallupo and Worzala, 2004). Topics included in MRE curricula in South Africa are shown in Table 2.

2. LITERATURE REVIEW

The property industry is a changing environment with new regulations and requirements being introduced regularly (Callanan and McCarthy, 2003). In order to produce graduates who are meeting industry requirements, it is important for universities to obtain comments from property practitioners to be used in curriculum improvement processes. Massey University involved employers in its process of curriculum review to produce learning that is recognisable by the industry (Callanan and McCarthy, 2003).

Butler, Guntermann and Woverton (1998) indicate that the intention of a curriculum is to graduate students who are better prepared to assume positions in the property industry. They noted too that this can be achieved when educators seek input from leading practitioners to assist in defining knowledge and skills required in a real estate curriculum. In addition, the multidisciplinary perspective of real estate studies which is covered more fully in built environment / planning schools and preferred by the industry for preparing students well for the industry must be supported by educators (McFarland and Nguyen, 2010; Chikafalimani and Cloete, 2010).

The property discipline today is also subjected to extraordinary forces that redefine its attributes and introduce new expectations for those with property involvements (Roulac, 2002). A comprehensive understanding of these factors by interacting with the industry can support educators in the process of curriculum improvement. Some of the prominent forces and factors which have caused change in the industry include: urban form changes and problems; globalisation; information technology advances and environmental concerns (Chikafalimani and Cloete, 2008). As a consequence, a larger view of the requisite knowledge for the property discipline in the 21st Century is significant (Roulac, 2002).

Table 1: Details of Masters Real Estate programmes in South Africa

University & Dept / School	Name of degree	Admission requirements	Period	Delivery	Total credits
Pretoria (Construction Economics)	MSRE	.Hons, 4 or 5 yr relevant degree	2 yrs and treatise	8 block weeks	230

		Work experience			
Witwatersrand (Construction Economics & Management)	MSPDM	Relevant good bachelors degree Work experience	1 yr full time, 2yrs part time & treatise	1 week block release	180
Cape Town (Construction Economics & Management)	MSPS	Hons or 4 yr relevant bachelors degree Work experience	2 yrs & treatise	Block system	180
Free State (Quantity Surveying & Construction Management)	MPS	Relevant good bachelors degree	2 yrs & treatise	8 work-shop weeks	240
Nelson Mandela Metropolitan (Construction Management & Quantity Surveying)	MSBE	Relevant good bachelors degree .Work experience	1 yr full time, 2 yrs part time and treatise	4 or 5 block weeks	202
Key: MSRE: Master of Science in Real Estate MSPDM: Master of Science in Property Development and Management MSPS: Master of Science in Property Studies MPS: Master of Property Science MSBE: Master of Science in Built Environment					

However, Manning and Roulac (2001) lament that while it is appreciated that innovations have been introduced to improve university education to serve society and the industry, it is widely recognised that university education is being slower to respond than institutions in society to recent social, technological and economic changes. This study was undertaken to partially address this criticism by ensuring that MRE education in South Africa remains relevant to the industry.

Table 2: Topics included in MRE curricula in South Africa

	Topics
1	Property finance
2	Property development
3	Property investment
4	Property economics
5	Property valuation
6	Property management / Facilities management
7	Financial management
8	Property law
9	Building economics
10	Research
11	Property marketing
12	Construction contract law

13	Property tax
14	Building technology
15	Environmental economics & management
16	International real estate
17	Information technology
18	Corporate strategy

3. RESEARCH METHODOLOGY

To collect comments to be considered in MRE curricula from the industry, a questionnaire survey was administered. Property professionals were presented an open-ended question to gather comments on the curricula. Included in the questionnaire was a list of eighteen topics covered in MRE curricula in South Africa shown in Table 2. The questionnaire was sent to 777 property professionals in South Africa; 748 of these were delegates who attended the 38th South African Property Owners Association (SAPOA) International Convention and Property Exhibition held at the International Convention Centre in Durban, South Africa and 29 were first and second year students enrolled in the Master of Science in Real Estate programme at the University of Pretoria in South Africa. Out of 777 questionnaires sent, 250 questionnaires were returned, representing a 32.2% response rate. The SAPOA members and delegates were surveyed because SAPOA is the representative body and official voice of leading property owners and investors in South Africa, and delegates represented both the private and public sectors of the property industry. SAPOA members include property professionals from different real estate fields and geographical areas in South Africa. This minimises response bias. MSc (Real Estate) students studying at the University of Pretoria were included in the property industry survey because most of them are working and know what is expected in the workplace.

Table 3 provides descriptive statistics of the survey respondents. By qualification, 86.4% of the respondents had formal university education. With regard to work experience, 23% were recent graduates with 0 to 5 years of experience. Comments from this category were based on recent university real estate course content. Respondents with 6 to 15 years work experience were the largest cohort group representing 41.2%, while those with 16 years or more of experience represented 35.2% of respondents. The last two categories are considered more experienced and are employers or mentors of the recent graduates. Geographically, statistics show that all provinces in South Africa were represented by respondents in the survey. In addition, 5.6% of the respondents operated internationally, indicating that real estate business was indeed growing and gaining importance globally (Roulac, 2002; Schulte and Schulte-Daxboek, 2003).

4. RESULTS AND ANALYSIS

As expected from an open-ended question, a variety of comments were submitted. Some comments were not helpful. However, most of the comments given were constructive and could contribute significantly

towards curriculum improvement.

When the comments from the practitioners were analysed it is noted that they are diverse in nature and comprise of two main groups: (a) weaknesses of the curricula and curricula needs; and (b) strengths of the curricula. One important comment given by the professionals related to the strength of the curricula is that the curricula are comprehensive. This means that the MRE curricula in South Africa are interdisciplinary and contain all topics required for a graduate to function competently in the industry as a property professional. These topics are given in Table 2.

Table 3: Description of Statistics of Survey Respondents

	No.	%
Qualification		
Matric	19	7.6
Bachelor's degree	77	30.8
Honour's degree	66	26.4
Master's degree	70	28
Doctorate degree	3	1.2
Other	15	6
Total	250	100
Current Property Industry Involvement ^a		
Academic / trainer	22	5.5
Property Developer	80	19.8
Property Valuer	37	9.2
Property / Facilities Manager	72	17.8
Property Investor	48	11.9
Property Broker / Marketer	35	8.7
Property Finance	55	13.6
Property Economist	6	1.5
Building Contractor	11	2.7
Other	38	9.4
Total	404	100
Category of Years of Experience		
0 to 5 years	59	23.6
6 to 15 years	103	41.2
16 to 42 years	88	35.2
Total	250	100
Geographical location		
Gauteng	138	55.2
Northern Cape	1	0.4
KwaZulu-Natal	27	10.8

Eastern Cape	5	2
Mpumalanga	3	1.2
Western Cape	27	10.8
Free State	2	0.8
National	33	13.2
International	14	5.6
Total	250	100
Note: ^a Some respondents reported more than one property industry involvement so the total is > 250		

Some of the critical weaknesses and curriculum needs raised by the professionals in the survey are:

- Inadequate practical component in the curriculum;
- Lack of case studies.
- Consider writing / communication skills.
- Involvement of guest lecturers.
- Experienced lecturers are ideal for valuable education.
- Graduates require an understanding of what is expected of them in an employment environment, often graduates are clueless when inducted into an employment environment.
- Curriculum must include real estate issues for the entire Southern Africa region because a good number of students attending courses coming from there.
- Curriculum must be relevant in South Africa.
- Site visits and discussions with industry professionals must be included.
- Invite motivational speakers.
- All assignments must be based on practical problems.
- Experiential learning must be considered.
- Modules should not be seen in isolation because project success is determined by a combination of information obtained from several modules.
- Students should have basic property knowledge before undertaking these studies.
- Consider social aspects of property development.
- Property courses related to property or land ownership and redistribution initiatives must be considered in South Africa, including black economic empowerment, property and construction charters.
- Students should be grouped and produce a full property development and management mock assignment.
- Organise property development educational tours.
- Issues on how to deal with tribal or customary land for development must be considered.
- Consider business skills.
- Consider issues of leadership.

In terms of ranking of the comments by response frequency, responses on comment 'inadequate practical component' ranked first. Second is 'case studies'. Ranked third are demands for 'writing / communication skills, guest lecturers, and experienced lecturers'. Based on these results, two important concerns are raised by the property professionals. Firstly, the existing curricula are not covering adequately the practical issues required in the industry. This requirement could be based on the fact that 'practicals' supported students to immediately become productive when they join the workplace. The finding is in line with a recurring theme in research which continues to emerge: a graduate programme must possess an appropriate blend of theory and practice to succeed in the eyes of the property industry (Gallupo and Worzala, 2004). Secondly, the industry is demanding that writing / communication skills be emphasised in the existing curricula. This result is again in line with observations noted by Gibler (2001) and Miles and Trefzger (2006) that there is a continuing high demand for effective writing and communication skills in the workplace.

5. CONCLUSION

Results of the property industry survey show that MRE education programmes offered in South Africa have both strengths and weaknesses. The main strength of the curricula is that property professionals commented that the curricula are comprehensive in nature. The impression given by the practitioners is that property should be viewed broadly, and for graduates to function competently in the industry they need to be exposed to different topics relevant to proper understanding of property. The practitioners are in favour of the interdisciplinary approach to the study of real estate.

In the survey two main weaknesses of the curricula were identified. Firstly, respondents express a general feeling that even though the existing postgraduate real estate curricula in South Africa are traditionally strong, they have not adequately prepared property professionals to deal with new challenges and needs which have emerged in the industry. Respondents feel that the existing postgraduate real estate curricula in South Africa have not adequately exposed students to practical property issues. The opinion of the practitioners is that the curricula are putting too much emphasis on theory and not on property practice. Secondly, the practitioners have pointed out through the survey that they want experienced lecturers to be involved in the teaching of MRE students. This makes sense because most of the postgraduate real estate students are working and it is inappropriate for them to be taught by less experienced lecturers since they do not add value to their studies (Hardin, 2000). In conclusion, it is then recommended that the universities offering MRE programmes in South Africa and elsewhere, consider comments given by the property professionals in the survey in the processes of curriculum improvement and development in the future in order to meet industry requirements.

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