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AIMS AND SCOPE

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Dear Industry Stakeholder,

Dear Industry Stakeholder

This is the 3rd Issue of JoC Volume 8. Given our decision to convert JoC to an Open Access Publication stated in our Open Access Statement we are gradually making several strategic changes which will become evident in the next issues.

For example, we have applied for an Electronic ISSN Number, we are investigating a separate website for JoC and are now charging a publication fee.

We trust that you will continue to support our Journal as an outlet for your research. We will be publishing the final issue of Volume 8 in December.

Yours in Research.

Ferdinand
F C Fester
President
ASOCSA
September 2015

JOURNAL OF CONSTRUCTION



EDITORIAL

The third issue of Volume (8) of the Journal of Construction (JoC) hosts four papers that covers various topics in construction contributed by authors from both South Africa and beyond.

Firstly, Emuze, Mputa and Botha carried out a phenomenological study of candidate professional development in South African construction. Secondly, Mwemo and Maritz examined the Current Status of the Adjudication Practice on Public Sector Construction Contracts in South Africa. Thirdly, Othman, Balaha and Fester investigated the use of risk management in the re-design process for re-use of existing buildings and, finally, Hayman, Loggia and Trois investigated the sustainable grid infrastructure: examining the Co-evolution of socio-economic and socio-technical systems through the microgrid adoption.

Overseeing EDITOR: Prof. Theo C Haupt, Ph.D., M.Phil., University of KwaZulu-Natal, Durban South Africa.

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A PHENOMENOLOGICAL STUDY OF CANDIDATE PROFESSIONAL DEVELOPMENT IN SOUTH AFRICAN CONSTRUCTION

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PURPOSE: Improvement of hard and soft skills, job security and other employment considerations are influenced by the education and training of a candidate professional who is keen to register with a built environment statutory council in South Africa.

ABSTRACT

Purpose:

Improvement of hard and soft skills, job security and other employment considerations are influenced by the education and training of a candidate professional who is keen to register with a built environment statutory council in South Africa.

Methodology:

The study, which is reported upon in this paper qualitatively assessed how candidate built environment professionals perceive their work in relation to their quest for professional registration. The phenomenological study underpinning this paper used face-to-face interviews to interrogate the issues among purposively selected professionals who are working towards professional registration with statutory councils affiliated with the Council for the Built Environment (CBE) in South Africa.

Results:

The study shows that the majority of the interviewees agree that employers need to promote training programmes that would assist candidate professional in South Africa. The main reason for this assertion is centred on the need for candidate professionals align their training with the requirements of registration councils.

Value:

Candidate professions that participate in employer assisted training programmes would be more secured about future employment prospects in the industry.

Keywords:

Built Environment, Job Security, Professional Development, South Africa

INTRODUCTION

In South Africa, government projects are often used to redress past social separation and its effects. Through various agencies, the South African government has intervened in the training and mentorship of artisans in the construction industry¹. This is not the case with professional development in the construction industry. The construction industry produces the built environment, which comprise all immovable assets in an economy. This suggests that consultants and contractors alone cannot eradicate the professional skills deficiency in South Africa construction industry. Thus state interventions that support the professional skills deficiency in South Africa construction industry could contribute to closing this gap. In developing countries, it is often assumed that the state can — and should — play a dominant role in the provision of training². The research project that is presented in this paper addressed candidate professionals in consulting and construction firms regarding their perceptions about professional development, training and levels of job insecurity in the construction industry. The study attempts to surface issues that impact on professional development in the built environment professions. Thus, this paper addresses:

- What are the connections between job insecurity and the development of candidate professionals?
- How should employers assist candidate professionals working towards registration with relevant councils?

REVIEW OF RELATED LITERATURE

Job security is defined as an important employee perceptual factor in determining satisfaction and intentions to stay with a

company³. This suggests that perceptions and emotions of employees are involved in the determination of job security and, as such, are important in every work environment. In other words, the views and emotions that manifest themselves in employees can influence the state of job security perceived by an employee.

The extant literature suggests that construction organisations show poor commitment to the development of people due to the belief that it is a costly function⁴. The unique characteristics of the industry have implications for job security. As an illustration, when the overall business climate is buoyant, few workers are unemployed; productivity increases and not many firms go bust. At other times, however, business is not good, there are many unemployed workers, cutbacks in production occur and a significant number of firms are in receivership⁵. This clearly indicates that during times of wealth in the macro economy, job security is also at its peak. This is attributed to the fact that during this time, threats of unemployment are dormant, productivity is high and business is on the upswing. The reverse is also true that during times of the economic crunch, job security is also at its lowest due to cutbacks in production. This may eventually lead to an increase in the number of retrenchments, something which contributes to an increase in the unemployment rate of a country.

Job insecurity leads to a range of outcomes among employees. Anxiety and stress are notable among the outcomes⁶. When stress is caused by job insecurity, it can be suggested that employees may take a decision to leave the place of employment. Alavi et al.⁷ further substantiates this by reporting that:

"...job insecurity, job dissatisfaction, and search for new job can be described as immediate attempts to avoid an insecure job setting."

Noble³ further explains by referring to Maslow's theory that job security falls within the category of safety needs. According to van Zyl et al.⁸, if the needs and goals are frustrated, this may have, "...a psychological impact on those affected..." If these needs are not satisfied, they may have psychological impacts.

These needs are also called deficiency needs because if these needs are not met people may not have the chance to develop themselves both physically and psychologically⁹. Therefore, an employee who feels constrained may inevitably find it difficult to perform optimally. In the context of job security, Noble³ contends that a relationship between performance and job security exists. This implies that employees may not expend effort in the future if they perceive that the link between performance and rewards is not strongly correlated⁹. There is a positive correlation between job insecurity and expenditure on the labour market¹⁰. The more flexible a country is with minimum intermediate level of employment protection, the better the country may perform in the labour market. In other words, the public sector could implement policies that should address concerns related to job security in the labour market.

With such a policy, high levels of skills could be enhanced and promoted in order to shift the negative perception and fear caused by job insecurity. This combination must be supported by government spending in the labour market to ensure continuity and also ensure new entrants in the market can maintain a high level of job security. In a European Union (EU)-based study, a suggests that countries should invest an amount of approximately 4.5% of the GDP on an annual basis on the labour market¹⁰. This may be done so as to have an impact on a high unemployment rate, and increase the skills level of the labour force.

To encourage high level of skills in the labour market, human resource (HR) development interventions must be structured to yield the required training results. This can be done by using training that helps ensure that activities are aligned with the requirements. Another dimension of looking into the value chain is the life cycle for professional development. The development of professional skills is a chain of stages or phases. Each stage is dependent on the success of the previous stage. Ideally, employees should receive development interventions that are aligned to where they are in the life cycle. The cycle starts with basic education and moves to professional formation through higher education and the candidacy stage before professional practice is assured. Explanations concerning the cycle can be made through the HR development practice described shown in Table 1.

Table 1: Conception of human resource development

Function	Focus	Purpose
Education	Learning related to preparing the individual for a different but identified job.	Preparation of an individual for an identified job in the not - too distant future.
Training	Learning related to present job.	Improve performance on the present job for the individual.
Learning	Using practice or experience gained from education and training to develop the individual, team or organisation.	Ensuring or realising a relatively permanent change in behaviour. This can only be achieved if attention is paid to 'Transfer of the learning' to the actual workplace situation
Development	Learning related to the growth of the individual, related to either specific present or future job requirement.	General growth not related to any specific job.

Source:¹¹

If the life cycle for professional development is connected to the Nadler's table, it can be concluded that each type of function becomes more important than the other at different stages of the life cycle. To make a practical example: during the school stage (Grades 10 - 12), education is the most important function en route to development. This is, however, a long way off

professional registration. After acquiring successful results from school, an individual is then enrolled in a higher education institution. Upon enrolment, the individual goes through a more focused education. This focus is based on the industry and the sphere of study within the particular industry. Graves and Epstein¹² describe this type of development as the self-

awareness necessary to transit from student into emerging professional. Some institutions use a combination of education and training (in-service training) for development at this initial stage. In some instances, depending on the profession, the training and the learning functions are used as medium for development. Here, the candidate is trained in all aspects pertaining to the discipline. At the end of the candidacy period, the individual should be registered with a relevant council. The most vital medium after the individual is registered is the development function. This is a continuous professional development (CPD) cycle until the individual retires. CPD is an umbrella term for post-qualification learning that enables professional and personal development¹³. However, CPD is available for qualified professionals and candidate professions.

RESEARCH

RESEARCH METHOD

The method chosen for conducting the qualitative study was through interviews in accordance with the phenomenological approach¹⁴. A phenomenological study like this one describes the common meaning for several individuals of their lived experiences of a phenomenon¹⁵. This method allow researchers to focus on describing what all participants have in common as they experience a phenomenon – difficulties in the candidacy phase of professional registration in the case of this particular study. The basic purpose of phenomenology is to reduce individual experiences with a phenomenon to a description of prevalent essence. This description often consists of “what” they experienced and “how” they interpret their experiences¹⁵. Interviews were chosen as being appropriate for this study as this method allows for capturing and preserving of the soft human variables that are attached to the subjective nature of the topic¹⁴. The interview protocol comprise of 19 questions with the exception of demographic questions. The interview protocol was developed so as to ask the same questions regarding this research project throughout the rest of the interview exercise. This was done to ensure consistency in the trajectory of the interviews.

The interview protocol allowed open-ended questions, which were used for clarification and exploratory purposes¹⁶. The interview protocol contained semi-structured questions in order to probe the individual’s viewpoint regarding subject matter. The reason behind the chosen form of data collection was to create a reciprocal two- way communication with the participating candidate professionals. The time expended for the actual interview was approximately 20 to 40 minutes per interview. This excludes the time expended on introduction and reassurance of confidentiality of the contents of the interview. Interviews were conducted with 14 participants. A typical sample size for interviews is from 5 to 25 individuals¹⁷. The interviews were tape- recorded and transcribed thereafter.

The sample was made up of interviewees who were under the employment of consultants, government entities and contractor organisations. Potential participants were registered as candidate professionals with different councils affiliated to the Council for the Built Environment (CBE). Of the 14 interviewees, five have recently exited the candidacy phase of their development and registered with ECSA as professional engineers. The nine candidate professionals that were still in the candidacy phase are affiliated to the South African Council for the Quantity Surveying Professions (SACQSP), the South African Council for the Project and Construction Management Professions (SACPCMP), the South African Council for Landscape Architectural Professions (SACLAP), and the South African Council for the Property Valuer Professions (SACPVP). The interviewees were contacted through email and the telephone. The registered interviewees recently

registered with ECSA so they are well placed to reflect upon their candidacy phase experience. A follow-up telephone call was made to further discuss the background to the research interview with the participants. The participants were also reassured about the contents of the study and clarification of any questions that the participants had regarding the interview.

RESEARCH FINDINGS

Demographic Information

According to their gender, there were six female and eight male interviewees. Ten interviewees were classified as youth (below the age of 36). Nine of the participants in this age group were interviewed because they had less than ten years of experience in the industry and were still undergoing candidacy training. As mentioned earlier, five of the interviewees just exited the candidacy phase of their professional development. All participants qualified for professional registration. Nine of the interviewees had less than six years of industry experience, whereas five of them had been in the industry for over six years. All participants were affiliated to councils under the CBE. These councils include ECSA, SACQSP, SACPCMP, SACLAP, SACPVP, and the SACAP (South African Council for the Architectural Professions). The CBE is a statutory body established in terms of the CBE Act No. 43 of 2000.

THEME 1: Candidate professional training

To shed light on this theme, seven questions were asked. The first question asked the interviewees if they are satisfied with the investment that their employers have made with respect to their training and education. Nine interviewees responded in the affirmative with regard to this question, while three replied ‘no’, indicating that they are not satisfied with the organization’s education and training investment. One interviewee was very impressed with the training that his organisation offered. Because he had the opportunity of furthering his studies, the organisation has given him the responsibility of training others in the firm. Half of the interviewees regard the training that their organisation offers as satisfactory. They believe that the training offered is organised in such a way that they can apply it in their day-to-day job routines. This training can also add value in such a way that it increases the candidate’s prospects for professional registration and / or for collecting continuous development points for those that have already reached the stage for professional registration. Interviewee number 7 offers a very diplomatic response when he says, “*A piece of bread is better than nothing.*”

The second question of the theme elicited responses as to whether job-related training and education that the interviewees have been exposed to in the industry is structured for purposes of registration as a professional in the industry. In response to this enquiry, some of the interviewees noted that their employers do not offer structured programmes for job-related training. Interviewee number 4 stated that “*we have to search for our own training and development*”. He further mentioned that “*we always seek information from councils and associations and the internet.*” For the young aspiring candidate professionals, a structured training programme offers guaranteed exposure to all the areas of work experience as required by the relevant councils. This ensures that the respective mentors cover all the areas needed in foundational training in each discipline. The structured programme prompts the mentor or supervisor to leave no stone unturned regarding training during the candidacy period. The structured programme can also act as a basis on which HR can review the progress and the return of investment of the training programme and also make a decision on the introduction of an HR intervention. Interviewee number 1 responded by saying, “*You get trainees that are just idling and nobody looks after them. If HR had a clear training plan and*

knew exactly where to place the candidates in the organisation for training, then no candidate would be idle."

Nevertheless, 13 interviewees confirm that their employers sponsor their job-related training and education. This job-related training is deemed to be adequate by the respondents. The participants for interview 8 was satisfied with the job-related training and said that "we are exposed to everything." In general, the interviewees were satisfied with the status of training and education that is available where they were currently employed.

THEME 2: Job security

The majority of the respondents seem to understand the relationship between management goals in relation to training and education. The participant for interview number 4 gave his impression of these goals. The respondent answered, "*Yes I do understand management goals, and even though I'm not sure... I don't know where management stands on that aspect.*" This perhaps may be caused by the fact that management does not always cascade the vision to members of the organisation at an operational level, or perhaps it is a case of management not making the goals towards training and education a priority.

Participants for interview number 7 explained that "*They (management) are trying. It is better than nothing.*" The participant for interview number 1 suggested that management goals in the organisation are focused, "*... mostly (concentrate) on company performance more than training and education. There is no real link as such; I think they are looking more at the performance indicators of the company rather than training and education of a candidate who needs to register with a professional council*" This suggests that employers may, due to certain constraints, be ignorant of the training and education required for professional registration. This finding negates the perception that a strong professional technical skills base can be used as a competitive advantage.

When the interviewees were asked whether they could explain or describe how management training and education goals have impacted on employability in the sector, their replies were: interviewee number 3 explained that, "*I would say it helps in formally applying methods and formulas needed for work. Through training, interaction with project team members from different educational backgrounds and also networking with other professionals from different organisations is easier.*" The interviewee suggests that through proper training it is easier to be confident about one's input in the project arena. The interviewee also expressed the view that it is easier to build a network with other professionals from the larger built environment fraternity as this increases one's employability in the sector.

The participant for interview number 5 was among those who said that they did not understand that management goals could be related to training as mentioned earlier. In addition, the same interviewee says, "*....before the training and my B-Tech, opportunities were very scarce and limited. With the B-Tech, I have secured a number of interviews in recent months.*" This suggests that management for this organisation is not explicit about training and development through company policies. This makes it difficult for the employees to map out their future prospects within the organisation.

Most of the interviewees agreed that there are structured training programmes introduced due to specific team requirements. This is to ensure that technical skills are complemented with other soft skills. The participant for interview 9 made a practical example for such programmes. The interviewee explained that, "*Currently we want to train people or ourselves on the issues of contracts. This is for the Joint Building Contracts Committee*

(JBCC) and the New Engineering Contract (NEC) group of contracts. As we have seen, the projects that we are running are not managed correctly within our department. There are groups that have started to undergo training, at the end we will all attend. We should know about this by now. We are involved in this industry but we cannot say what we knew (in terms of the laws, terms and references) five years ago still applies today as they keep on changing." This comment suggests that it is incorrect to just focus on rigid technical skills without paying attention to the complementary skills that will ensure that relevant laws are not contravened.

It is known that an architect should provide the team with a plan or design, the quantity surveyor with a bill of quantities, the project manager with the management tools and techniques for a project. Among the technical skills, poor contract management could lead to the complete halt of a project or even destroy the entire prospect of a project.

When the interviewees were asked to mention and describe formal HR processes used for closing existing skills gaps according to the structured training programme in their firm, these were the responses: the participant for interview 2 said that "*I know of the skills audit programme within the organisation that was adopted. HR along with qualified practitioners researched whether people are placed correctly in terms of their skills, competence and ability.*" The participant further said that, "*...but I have never heard of them taking any decision regarding what to do with their findings.*" The participant for interview 9 answered and said that "*The training that we undergo is initiated by ourselves as project managers, and there is no HR involvement during the identification process. Then we inform our senior to cater for such training during the budgeting process.*"

The argument is that there is no formal process for identifying skills gaps for most organisations. HR interventions are almost always tactical in nature, unplanned, have no structure that adds value and the outcomes or the return on investment is never measured. The participant for interview 2 opined that, "*Well, since I joined the organisation, I have attended a lot of training. As to how they fit into my being a project member, I have not necessarily seen the connection. We are just running to get training and there was no point where I was evaluated as to whether perhaps I am adding value to the project based on such training. The assumption is that I am good enough so far.*"

Ten of the interviewees affirm that there is a formal process where they hold regular reviews and adjustments to project-specific HR performance in their individual firms. In particular, the participant for interview 1 describes this process as, "*Mostly at project milestone when certain milestones are achieved, you go through the reviews and also look at HR needs of the projects, if there is a need to beef up you do that and if there is need to go out and get the external skills and expertise you do that. We do the milestone reviews and then HR is one of the areas we look at and also the performance of the human resources within the team.*"

THEME 3: Professional development

Most of the interviewees were of the opinion that their employers are familiar with all the laws surrounding required training and education in the construction industry. The participant for interview 4 added that, "*....but I'm not really sure at what level they are in terms of knowledge of the subject area.*" How well is HR department familiar with the requirements for professional development? When HR is on a course for skills development what guides their training course, if not the professional development laws? The participant for interview 2 opined that "*To a certain extent, employers are knowledgeable, but what*

they know is neither the best of it nor the poorest." This suggests that HR knowledge of the project team regarding the laws for training and development are a grey area.

The participant for interview 1 suggested that, *"...if you don't know, you won't bother about this training and try to develop yourself, but if you know about these rules, obviously you will follow certain steps to make sure that you are equipped. And when you also compare yourself with your peers, you will always want to be a step ahead."* If the individual does not know the training protocols required by the councils, then HR cannot take you through them through proper training. The participant for interview 2 suggests that, *"They do expect us to practise a certain level of professionalism guided by our councils that we subscribe to, but as how to help us practise relevantly, they are not doing anything."*

The participant for interview 3 strongly answered that the education deficit of HR regarding these laws, *"... affects the employee in a manner that HR will not highlight or they cannot encourage the development of individuals in the construction sector because they are not aware of what we do in the construction sector term as achievement. Just as long as the post is filled to them it's OK."* Participants for interview 8 suggest that, *"If they are aware of the laws then we get trained according to regulation or council or whoever needs to approve them. Chances of you getting derailed are lowered because they know..."* If the knowledge that governs built environmental laws is not known, then HR and employees can never be sure of how to align them with the training requirements of the built environment councils. Employees as industry patriots must show interest in educating HR and management about the correct training protocol. With the correct training protocol, chances of differing are kept at a minimum.

Eleven of the interviewees regard their employers as receptive to training and education for a professional career. The participant for interview 7 suggests that their organisation, *"... even goes to the extent of allowing us to leave as early as 1 pm, so we can go and study in the afternoon. The supervisor is aware."*

The participant for interview 2 insists that, *"They always say only if it is job-specific and related to what I am doing at the organisation. Any other management programme would not be approved. I have attended a few but I'm not satisfied..."* More than half of the interviewees agreed that there are limited career progression opportunities in their organisations. Only six of the fourteen interviewees believe that the training and education opportunities that are available at their organisation are adequate for career advancement in the sector.

The participant for interview 2 responded thus, *"If they improve to a level where they look at what you want to achieve professionally and not only delivering on what you are doing now, then it would meet the needs for professional development."* Interviewee for interview 3 mentioned the point that HR goes beyond than just recruitment and filling posts. It is also about management of the development of that resource.

DISCUSSION

The challenges that are faced by candidate professionals, which also impinge on professional registration, were explored. The challenges include:

- a) The lack of support that can diminish job security;
- b) The imbalance between professional training and other forms of training required to excel as a professional, and

- c) The lack of programmes that support professional skills development.

The literature firstly tapped on the impasse called job insecurity. Job security is an impasse because it affects the individual's ability to progress¹⁸. Job insecurity affects the individual's psychological ability, negatively affects the individual's ability to perform his duties and negatively affects the growth of an organisation. This creates a problem for development.

Soft skills were identified by interviewees as project management skills, contract management skills, project monitoring and evaluation skills, project scheduling skills and courses on preparation for council board examinations. The participant for interview 2 stressed that he is confident with his ability to deliver on his duties, but would still require more training that is beyond the technical scope.

The findings show that technical abilities are not enough¹⁹. One also needs the ability to manage outputs, people, to know about the impact that a technical professional has on a contract. Furthermore, one also needs to be able to manage conflict in the workplace. All these are key attributes that ensure that the project is executed as expected. It is important to overcome the educational / training mismatch since such a mismatch has a negative influence on job satisfaction in the Architectural, Engineering and Construction (AEC) sector²⁰.

Findings from the study indicate that HR departments do make an effort to invest in training and development. The training programme offered by some employers, however, often not structured. A structured programme offers guaranteed exposure to all the areas of work experience as required by the relevant councils. This also ensures that respective mentors cover all the areas needed in foundational training in each discipline. The structured programme can also act as a basis on which employers can review the progress of the programme and also measure the return on investment of the training programme. If a training requirement is lacking (skills gaps that are apparent) from the programme, then an employer can quickly identify the need and make a decision on the introduction of an intervention to fill the skills gap²¹.

It is apparent that the management of most organisations does offer these training programmes. It is perceived that the training programme that they offer adds value to job performances and company performance²². Knowledge and understanding of the importance of HR development on infrastructure project is adequate. However, HR techniques for identifying education and training requirements seem to be more biased towards technical skills. Findings from the literature review indicate that HR departments need to take a systematic approach in the planning for training and development⁴. In this way, practice based training required for soft skills can be catered for. Soft skills complement hard skills gained from tertiary education. Organizations undertaking a leadership development initiative have to look beyond simply evaluating training programmes since success depends not only on effective training but also on expert facilitation, contextual awareness, formal and informal support, real-world application, self-study, and self-awareness²³.

Management goals to aid job security through training and development were to some extent understood. The subject 'training and education' is one that forms a prerequisite in the relevant councils for a candidate's route towards professional registration. Lack of training also makes the candidate vulnerable to non-registration and, by extension, job insecurity. Training is essential in mastering the discipline through practice and also in the meticulous application of technical knowledge

gained through tertiary education. Upon mastering the discipline, it becomes easier for individuals to be confident about their role in a project team. It also becomes easier to build a network with other professionals within the built environment fraternity. This increases one's employability in the sector and thereby increases job security. It seems that there is a connection between a lack of professional development and job insecurity. The lack of training could be detrimental to a candidate professional with regard to professional registration. Management must be explicit about training and development and reflect such commitment in business strategic plans and creation of training policies and procedures. Without this undertaking, it makes it difficult for the employees to map out their future prospects within the organisation. Training programmes are integrated within the projects which focus more on technical skills. There are, however, other structured training programmes introduced due to specific team requirements which may focus on soft skills of leadership – empathy, compassion, etc. Most employers are familiar with the legislation that governs training and education for the built environment professions. If the knowledge of built environmental laws is not known, then HR and employees may never be sure of how to align them with the training requirements of CBE councils. Employees as industry patriots must show interest in educating HR and management about the correct training protocol.

CONCLUSION AND RECOMMENDATIONS

This research is an attempt to surface issues affecting candidate professionals in the built environment disciplines. The realisation of professional registration depends on post tertiary education exposure of candidate professionals. This research has flagged challenges that candidate professionals have to surmount in order to register as a professional that is licenced to practice in South African construction. One of the issues is that of job insecurity. This phenomenological study shows that job insecurity could be mitigated through structured skills development among candidate professionals. By analysing the life cycle of professional development, employers could administer programmes that would engender professional registration. In response to the questions posed in section of this paper, it can be argued that the connection between job insecurity and the development of candidate professions can be found in the nature of training and mentorship offered by employers. When candidate fail to partake in training programmes that could assist them with professional registration in their workplaces, the impasse of job insecurity tend to set into their minds. To subvert this scenario, employers should endeavour to promote training and development initiatives that can assist their employees to do the necessary work while aligning with the requirements of relevant councils.

Upon introduction of training interventions, employers could opt for a structured programme. Programmes may have the characteristic of a schedule of the training so as to administer training appropriate at differing stages or phases of the programme. Monitoring of the progress of this training intervention on a regular basis is important. Also, in order to create a feedback loop for lessons learnt, employers need to evaluate the outcomes of the training intervention so as to make adjustments to the training programme. The argument put forward in this paper is that it is important for employers to be conversant with the needs of candidate professionals in order to get optimum performance from them. The training of candidate professionals has to be tailored to the needs of the relevant professional council so as to ensure that registration and professional practice are attainable by the candidates. This would have positive effects on employees, the employers and the construction industry in general.

The findings illustrated in this research are however limited in the sense that only the perceptions of candidates and recent candidates were used to surface the emergent issues. It is therefore important for a further research to explore the perceptions of employers and mentors of candidate professionals in the built environment. More so, it will be a real service to the industry if a model for candidacy phase of professional registration can be evolved for use in the construction industry.

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REFERENCES

- 1 CIBD (2007). Construction Industry Development Board with the Department for Public Works Skills for infrastructure delivery in South Africa: the challenge of restoring the skills pipeline, Pretoria: CIBD.
- 2 Debrah, Y.A. and Ofori, G. (2006). Human resource development of professionals in an emerging economy: the case of the Tanzanian construction industry, *The International Journal for Human Resource Management*, 17(3), 440 – 463.
- 3 Noble, C.H. (2008). The influence of job security on field sales managers satisfaction: exploring frontline tensions, *Journal for Personal Selling and Sales Management*, 28(3), 247 – 261.
- 4 Raiden, A.B. and Dainty, A.R.J. (2006). Human resource development in construction organisations: an example of a "chaordic" learning organisation?, *The Learning Organisation*, 13(1), 63 – 79.
- 5 Myers, M. (2007). *Managing human resource development: a strategic learning approach*, 4th edition, Durban: Lexus Nexus.
- 6 Sverke, M., Hellgren, J. and Naswall, K. (2007). No security: a meta-analysis and review of job insecurity and its consequences, *Journal of Occupational Health Psychology*, 7(3), 242-264.
- 7 Alavi, S.S., Alaghemandan, H. and Jannatifard, F. (2013). Job Security at Isfahan university of medical science: implications on employees and types of contracts. *Mater Sociomed*, 25(1), 64 – 67.
- 8 Van Zyl, L., Van Eeden, C. and Rothmann, S. (2013). Job insecurity and the emotional and behavioural consequences thereof. *South African Journal for Business Management*, 44(1), 75 – 86.
- 9 Warner, A. and Bagraim, J. (2011). *Organisational behaviour: a contemporary South African perspective*, 3rd edition. Pretoria: Van Schaik.
- 10 Yanilmez, M.I. (2013). Labour market consequences of job security and labour laws in the era of flexicurity: implications for Turkey. *Journal of Knowledge Management*, 1(1), 26 – 44.

- 11 Analoui, F. (2007). Strategic human resource management, 2007, London: Thomson Learning.
- 12 Graves, N. and Epstein, M. (2011). E-Portfolio: a tool for constructing a narrative professional identity. *Business and Professional Communication Quarterly*, 74(3), 342 – 346.
- 13 Maharaj, S.S. (2013). Mandatory continuing professional development in South Africa: rehabilitation therapists' perspective. *International Journal of Therapy and Rehabilitation*, 20(7), 343 – 351.
- 14 Flick, U. (2014). An introduction to qualitative research, London: Sage.
- 15 Creswell, J.W. Qualitative inquiry and research design: choosing among five approaches, 2013, London: Sage.
- 16 Thomas, A.B. (2004). Research skills for management studies, New York: Routledge.
- 17 Leedy, P.D and Ormrod J.E. (2009). Practical research: planning and design, 9th edition. New Jersey: Pearson Education.
- 18 Emmenegger, P. (2009). Specificity versus replaceability: the relationship between skills and preferences for job security regulations. *Socio-Economic Review*, 7(3), 407-430.
- 19 Ikujiro, N. and Hirota, T. (1995). The knowledge creating company: how Japanese companies create the dynamics of innovation, New York: Oxford University Press.
- 20 Fuentes-del-Burgo, J. and Navarro-Astor, E. (2013). Do educational mismatches influence job satisfaction? In: Smith, S.D. and Ahiaga-Dagbui, D.D. (eds.) Proceedings of the 29th Annual ARCOM Conference, 2-4 September 2013, Reading, UK, Association of Researchers in Construction Management, pp. 237-247.
- 21 Tabassi, A.A. and Abu Bakar, A.H. (2009). Training, motivation, and performance: the case of human resource management in construction projects in Mashhad, Iran. *International Journal of Project Management*, 27(5), 471-480.
- 22 Fugar, F.D.K., Ashiboe-mensah, N.A. and Adinyira, E. (2013). Human capital theory: implications for the Ghanaian construction industry development. In: Proceedings of the 2nd International Conference on Infrastructure Development in Africa-ICIDA 2013, 14-16 March 2013, Johannesburg, South Africa, pp. 49-58.
- 23 Crosbie, R. (2005). Learning the soft skills of leadership, *Industrial and Commercial Training*, 37(1), 45 – 51.

AN EXAMINATION INTO THE CURRENT STATUS OF ADJUDICATION PRACTICE ON PUBLIC SECTOR CONSTRUCTION CONTRACTS IN SOUTH AFRICA

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PURPOSE: This paper discusses the existing adjudication provisions in the standard forms of contract, review current practices of contractual adjudication and thereafter evaluate the potential of adjudication as an alternative dispute resolution process in resolving disputes among public sector contracting parties.

ABSTRACT

Purpose

The concept of adjudication is no longer new in the South African construction space. All the modern forms of contract in use incorporate adjudication as a standard form of dispute resolution. However, a careful observation indicates that sufficient attention has not been given to adopting the adjudication provisions by contracting parties on public sector projects. This paper discusses the existing adjudication provisions in the standard forms of contract, review current practices of contractual adjudication and thereafter evaluate the potential of adjudication as an alternative dispute resolution process in resolving disputes among public sector contracting parties.

Design/methodology

The paper analyses the current status of adjudication practice in South Africa by systematically reviewing selected articles and documents on both contractual and statutory adjudication with emphasis on the South African construction industry. The methodology involves the examination and analysis of selected documents and published literatures.

Findings

The analysis of the selected documents reveals that there are adequate provisions for adjudication in the current forms of contract endorsed for usage in the South African construction industry. However, the public sector contracting parties rarely invoke adjudication provisions when disputes arise. This paper therefore provides a future direction by indicating the need to identify the constraints to effective adoption and invocation of adjudication provisions by public sector contracting parties.

Original/value of paper

The study adds to the body of knowledge by creating an insight into the potential of adjudication in resolving disputes among public sector contracting parties in South Africa. The study also alerts the industry to give adequate consideration to factors that can promote more effective usage of adjudication provisions by public sector contracting parties.

Keywords:

Adjudication, disputes, public sector, South Africa

INTRODUCTION

The importance of the construction industry in any country cannot be overemphasised. One of the indices for measuring the economic development of countries is the rate of construction activities and performance of their construction industry. This construction performance is a factor of industry-wide effectiveness and efficiency¹. As such, the construction performance basically relies on active participation of contracting parties and enabling environment for effective delivery of projects within the stipulated time. Disputes among contracting parties sometimes arise, hampering the smooth operation of construction projects and thereby jeopardizing the industry performance. Globally, the incidences of disputes in the construction industry have had different consequences on construction projects which range from delay in project progress to utter abandonment of construction projects². In fact, disputes have also been associated with poor construction work, project failures, complicated litigations, financial loss used in securing legal services and other adversarial relationships among construction professionals^{2, 3, 4, 5}. Unfortunately, this unpleasant situation has portrayed the construction industry with a reputation of being ineffective, contentious and adversarial, predominantly with regards to the relationship between the main

Table 1 : The survey respondents (CII reports)

Respondents/Year	2007	2008	2009	2010	2011	2012	2013	2014
Client	114	282	332	434	592	498	374	535
Contractor/subcontractor	219	1209	1169	1053	1300	1006	886	1519
Total	333	1486	1501	1487	1892	1504	1260	2054

Source: ^{16, 17, 18, 19, 20, 21, 22, 23}

contractors and subcontractors ⁶. The adversarial relationship among construction professionals is often acute, particularly on public sector projects due to lack of alternative dispute resolution (ADR) mechanisms ¹. These unfavourable relations also impact negatively on the overall cost of construction. Consequently, several construction stakeholders have advocated that something must be done in order to circumvent the situation ^{7, 8}. Unfortunately, the great expense of the traditional methods of disputes resolution (usually litigation and arbitration) has often discouraged small and emerging contractors from pursuing their legitimate right and as a result, they suffer financially ⁶. Thus, the challenges and frustrations associated with litigation and arbitration in resolving construction disputes have necessitated an increased demand for ADR and triggered the introduction of adjudication into the construction industry.

The Emergence Of Adjudication As An ADR Mechanism In South Africa

The South African construction industry is recognised as very large, diverse and complex in nature ⁹ with varied activities which bring together a variety of different professionals. The industry plays a vital role in South Africa's economic and social development. However, the industry is particularly plagued by payment defaults which have been reported to be a chronic problem affecting the delivery chain ¹⁰. The unpredictability of payments has in certain instances resulted in an extremely negative contracting environment ¹¹ and as such, disputes are not uncommon within the industry. Disputes have a significant effect and impacts on growth negatively and performance of the industry. In addition, the traditional means of resolving the construction disputes have not helped the matter as the time and cost associated with litigation and arbitration make the process undesirable. Hence, there have been concerns on how to strengthen the industry to face the present and future challenges. One of the efforts to face the challenges led to the promulgation of the White Paper entitled "Creating an Enabling Environment for Reconstruction, Growth and Development in the Construction Industry" ¹².

The White Paper provides a scheme that enables the construction industry to play a more strategic role in the socio-economic growth of the nation. It sets out Government's plans and vision for an enabling strategy aimed at enhanced service delivery, greater stability, improved industry performance, value for money and the growth of the emerging sector. It further focused the need for improved public sector capacity to manage the construction delivery process. The paper further recommended the establishment of an industry caretaker known as Construction Industry Development Board (CIDB) with the mandate to champion the process of creating an enabling environment in order to promote the industry at large.

Having recognized the entrenchment of ADR procedures for resolving labour disputes in the Labour Relations Act No. 66 of 1995 and the successful application of ADR procedures in the private sector, the CIDB in the 1999 White Paper to the Minister of Public Works, recommended the use of ADR, in particular adjudication, as litigation and arbitration were observed to be time consuming and costly leading to small and emerging

contractors' vulnerability in the event of major disputes arising. Hence, contractual adjudication was formally introduced to South Africa through the efforts of CIDB. In addition, the CIDB endorsed four forms of contracts documents namely, Federation Internationale Des Ingenieurs Conseils (FIDIC), New Engineering Contract (NEC), Joint Building Contracts Committee (JBCC) and General Condition of Contracts (GCC), all of which make provision for adjudication.

RESEARCH METHODOLOGY

This paper aims at evaluating the potential of adjudication as an ADR process in resolving disputes among public sector contracting parties in South Africa. In order to achieve the aim, the methodology employed included the examination and analysis of selected documents related to adjudication practice in South Africa. According to ¹³ this type of methodology approach is very advantageous because it provides the means of tracking changes and development as well as revealing the clear picture of how an organization or a program fares over time. This methodology approach has been used in quite a number of previous researches with the purpose of providing a future direction on an important issue ^{6, 14}. In order to provide an overview of the South African construction industry and determine its current status the study examines selected documents comprising of:

- Journals, books, and published literatures related to adjudication practice in South Africa;
- The CIDB endorsed standard conditions of contracts namely; the FIDIC, NEC, JBCC and GCC.
- A nationwide annual CIDB Survey known as Construction Industry Indicators (CIIs). The CII survey related to the completed projects between the period of year 2007 and 2014 were selected and evaluated. The survey involves the participation of the clients and contractors from all nine provinces in South Africa as indicated in **Table 1**.

RESEARCH DISCUSSION

The CII survey measures the performance of the construction industry, focusing on clients, contractors and other industry stakeholders. The importance of the survey cannot be underestimated because the survey connotes an aggregated view and perception of different industry stakeholders across the whole nine provinces of South Africa. The findings from the survey reveals continuous and increasing deterioration in both payment culture and management of disputes within the South African construction sector ^{15, 16, 17, 18, 19, 20, 21, 22, 23}. In fact, nothing less than 65% of the subcontractors in South Africa who are supposed to be protected by the adjudication mechanism have claimed to have experienced delayed payment ²⁴. The subcontractors also reported that this delay in payment has been the root cause of disputes within the South Africa construction industry ²⁴. Surprisingly, these subcontractors have been rather passive in invoking the adjudication provisions to address the issue. This situation has been particularly worse with public

sector construction contracts in South Africa. These findings therefore call for a need to determining the factors constraining the adoption of adjudication provisions among public sector contracting parties.

ADJUDICATION PROVISIONS IN THE STANDARD FORMS OF CONSTRUCTION CONTRACT

Currently, South Africa has four CIDB endorsed standard forms of construction contracts for both public and private sector construction works. Two of the forms are internationally developed (FIDIC, and NEC3) and the other two are home grown (GCC and JBCC). The contractual adjudication process has for some time now found a place in the two home grown standard form of building contracts in use in South Africa (GCC and JBCC), into which the adjudication process was introduced for the first time in 2004. As with many jurisdictions, the standard forms have undergone some amendments since its introduction into the construction practice in South Africa. The latest versions of the four standard forms are the JBCC 2014 edition 6.1, the GCC 2014 2nd edition (Revised), the NEC3 2005, 3rd edition and the FIDIC 1999 1st edition. In the current version of the forms, adjudication provisions are found under clause 30 of JBCC; clause 10.5 of GCC, Option W1 of NEC 3 and clause 20 of FIDIC. Each of the forms adopts a standard adjudication procedure. The GCC makes use of the CIDB adjudication procedures, The JBCC applies its own adjudication rules, The NEC provides for two adjudication procedures (Option W1 and W2) because of United Kingdom (UK) statutory requirements for adjudication. Option W2 is the Act compliant procedure for use in contracts subject to the UK's Act while option W1 is the NEC procedure applicable in South Africa. The FIDIC makes use of its own general conditions and procedural rules for adjudication. It is important to know that all the adjudication procedures needs to align with the principles underpinning adjudication in South Africa. Drawing some comparison from the four forms of contracts, the following points are observable:

Appointment:

The parties are to jointly appoint the adjudicator or Dispute Adjudication Board (DAB) by mutual agreement or by a named authority either at the beginning of the contract (standing adjudicator), or when disputes arise (ad hoc adjudication). The adjudicator's agreement is a tripartite agreement and must be co-signed by the employer, contractor and the adjudicator / adjudicators

Terms of appointment and conduct of adjudication:

The adjudicator is required to act fairly and impartially in accordance with the rules of natural justice. He is expected to act independently of the parties and treat all matters as confidential.

Procedure:

The adjudication process is not to be conducted as an arbitration. The adjudicator is permitted to decide on the procedure to be followed in adjudication. He is authorized to use his own initiative to ascertain the facts and laws necessary to determine the dispute. The adjudicator may use his own expert knowledge, order any interrogation, require /limit further submission of documents or decide on the language to use in the adjudication. The adjudicator can also conduct a hearing (though not usually encouraged) or call for meetings, carry out site visits and inspections as he/she considers being appropriate, carry out any test and experiment and can appoint an independent expert upon receiving the consent of the parties.

Determination:

The adjudicator is to reach a fair, rapid and inexpensive determination of a dispute arising under the contract. The

decision of the adjudicator shall be in writing, containing the reasons for his /her decisions if requested by any of the parties. He /she shall determine the amount that any of the parties is liable to pay to the other, the date the payment is to be given and other matters regarding the rights and obligations of the parties. The adjudicator on his own or upon the application of any of the parties may correct his /her decision so as to remove any clerical or typographical error arising by accident or omission within five days of the delivery of the decision to the parties. The corrected decision must be sent to the parties as soon as possible. The adjudicator's decision is binding and the parties must give effect to it regardless of any intention to take the adjudicator's decision on review or arbitration.

Payment:

The parties shall implement the adjudicator's decision without delay whether or not the dispute is to be referred to legal proceedings or arbitration. Payment (if applicable) shall be made in accordance with the payment provisions in the contract.

Miscellaneous:

The adjudicator is not liable for any act or omission in the cause of discharging his duty except if the act is done in bad faith. Evaluating these provisions, several factors have to be considered in order to reach a fair, rapid and inexpensive decision. Some of the provisions discourage any form of delay tactics which can hamper the progress of construction work.

- (i) The provisions require that there should be strict adherence to the time period specified under the procedure. Any extension to the time must be jointly agreed upon by the parties. The strict time frame in each of the procedures is to avoid delay. Although the time frame in JBCC is different from that of FIDIC and the other forms of contract, the procedure in the provisions is to allow for quick resolution.
- (ii) The decision of the adjudicator is immediately binding regardless of any intention to take the decision on review or on arbitration. It is therefore clear that the fact that prompt effect is to be given to the decision does not give room for any delay in project execution. In fact, the provisions require that parties should continue with their obligations in terms of the agreement, notwithstanding the disagreement between them.
- (iii) The parties are expected to comply with any request or direction of the adjudicator in the adjudication process. In case of default by any of the parties without a reasonable cause, the adjudicator may continue the adjudication in the absence of the party or the documents requested and take decision on the basis of information before him or her. This is to avoid the use of delay tactics by one party which may affect the speedy resolution of the dispute.

Looking at the provisions of the different forms of contract, the findings of ²⁵ that there are sufficient contractual provisions for effective practice of adjudication in the CIDB recommended forms of contract can be regarded as valid.

THE CURRENT PRACTICES OF ADJUDICATION AS ADR IN SOUTH AFRICA

As a matter of practice within the South African construction industry, the obligation to adjudicate is based on contractual agreement. This is different from the practice in the UK where

where adjudication is a creation of legislation, through the introduction of Housing Grant, Construction and Regeneration (HGCR) Act (1996)²⁶. The Act provides statutory right to either of the parties to invoke adjudication unilaterally. However, the adoption of adjudication provision in South Africa is by agreement between the parties as recorded in the construction contract agreement. The practice of contractual adjudication is not without some limitations. Of course, contractual adjudication have been in use in the 1980's but never widely accepted due to certain constraints²⁷. Some of the limitations include power disparity between the contracting parties and fear of losing future jobs by the weaker party. Lack of willingness of the weaker contracting parties to commence adjudication proceedings was a concern at the time of its introduction²⁸. The major concern of the weaker party (mostly the sub-contractor) was the fear of being denied future opportunity to tender for work²⁹. In effect, contractual adjudication was not widely used during pre-statutory era because its usage depends on the negotiating strength of the parties²⁷. This had led to the advocacy that adjudication has to be compulsory in order to have real impact so that powerful contracting parties would not strike it out from the contract they make²⁷.

In addition to the aforementioned limitations is the problem that arises when adjudication is not being adopted as a primary resolution mechanism. For instance, in Hong Kong, just like the case in South Africa, there is no statutory right to adjudicate. Adjudication is just one of the three tiered disputes resolution mechanisms which can only be invoked by agreement between the contracting parties. Therefore, the take up of adjudication was limited due to the fact that it can only be adopted at secondary level following mediation³⁰. However, this limitation has been addressed in many countries by making adjudication a creation of law. Following UK HGCR Act (1996), countries like Australia, New Zealand, and Singapore etc. have enacted similar legislation to back up the adjudication practice. At present, there is concerted effort within the South African construction industry to shift from contract based to statute based adjudication practices.

It is noteworthy that, despite all limitations associated with contractual adjudication, it has been adopted in the resolution of disputes in South Africa. Recent studies show that adjudication was effective in the cases where it has been employed^{31,32}. Even in the few cases where contracting parties had gone to court after adjudication (e.g. Basil Read (Pty) Ltd v Regent Devco (Pty) Ltd; Tubular Holding (Pty)Ltd v DBT Technologies; Esor Africa (Pty) v Bombela Civils), it was observed that most of the court rulings had aligned with the adjudicators' original judgments. In relation to this, the recent courts' support and robust approach in enforcing adjudicators' decisions has positively contributed to the increasing penetration of ad hoc adjudication into South African construction practice³².

OBSERVATIONS AND AREAS OF CONCERN

Recently, various researches have revealed that there is a growing preference for adjudication^{33,34}. For instance, many construction stakeholders would prefer the inclusion of adjudication as the priority in resolving a dispute before arbitration³⁵. Although both mediation and arbitration are effective, adjudication has advantages over mediation³⁴. In addition, it has been revealed that the construction industry stakeholders agreed that the introduction of adjudication will significantly reduce arbitration and litigation¹⁰. Based on the foregoing, it is expected that the use of adjudication would have increased significance in resolving disputes on public sector construction contracts when commonly applied as the first tier ADR process.

However, a thoughtful reflection of prevalent trends in the

construction industry revealed that the practice of adjudication in South Africa as an ADR process is limited to the private sector. This observation can be proved in two ways. First, by the numerous and increased complaints on payment default and other disputes (particularly on public sector projects) which adjudication provisions were originally intended to solve¹⁵. The CIDB CII results from 2007 to 2012 show a declining trend in prompt payment of public sector contractors which remains the major cause of dispute^{36,37}. Secondly, by the analysis of the few cases that eventually ended up in court after adjudication. For instance out of six cases that got to court between 2010 and 2014, five of the disputes were either between private employer and contractor, main contractor and sub-contractor and main sub-contractor and another sub-contractor. The only exception was the case between Freeman August Wilhelm N. O, Mathebula; Trihani Sitos de Sitos NO; v Eskom Holdings Limited of which Eskom is a public client. It can therefore be inferred that the public sector rarely invoke adjudication as an ADR process for its numerous disputes. Investigations reveal that litigation has remained the prevailing dispute resolution technique among public sector contracting parties in South Africa^{33,35}. It is therefore very disturbing that the advocacy of the CIDB that adjudication should be used to resolve disputes at both prime and subcontractor's level on both private and public sector contracts has not been implemented on public sector contracts. It can be easily deduced then that parties to public sector projects have very rarely invoked the adjudication provisions when disputes arise. This suggests that certain constraints or peculiarities are hampering the use of adjudication in public sector contracts. Something urgent must be done therefore to enable the public sector to tap into the benefit and prospects of adjudication.

FUTURE DIRECTIONS

The research review on adjudication practices in South Africa has identified future research directions as illustrated in Figure 1, and explained on the following page.

In line with the plan to introduce statutory adjudication in South Africa, the CIDB has recently prepared amended adjudication regulations that were gazetted for public comments in the Government Gazette Notice 482 of 2015¹¹. Once enacted, adjudication would carry legal enforcement within the South African construction industry. This development promises a better and greater result for the industry as far as dispute resolution is concerned. However, the potential inherent in the process of statutory adjudication would only be realized if the constraining factors to its effective usage are recognized and appropriate application measures are put in place. In effect, the empirical evidence of what should be done to achieve effective usage and pragmatic functionality of the practice of adjudication should be provided. The knowledge and outcome of such research will be of great benefit to all construction stakeholders.

CONCLUSION

The objectives of this paper are to discuss the existing adjudication provisions in the standard forms of contract, review current practices of contractual adjudication and thereafter evaluate adjudication potential in resolving disputes among public sector contracting parties. The literature reveals that contractual adjudication is no longer new in South Africa. The courts in South Africa have acknowledged the importance of this ADR alternative and have shown a robust approach towards enforcing adjudication decisions. In anticipation of a better performance of adjudication in South Africa, a draft regulation have been proposed to provide the statutory right to any party wishing to invoke adjudication provisions. However, the public sector has not tapped into the advantages of this

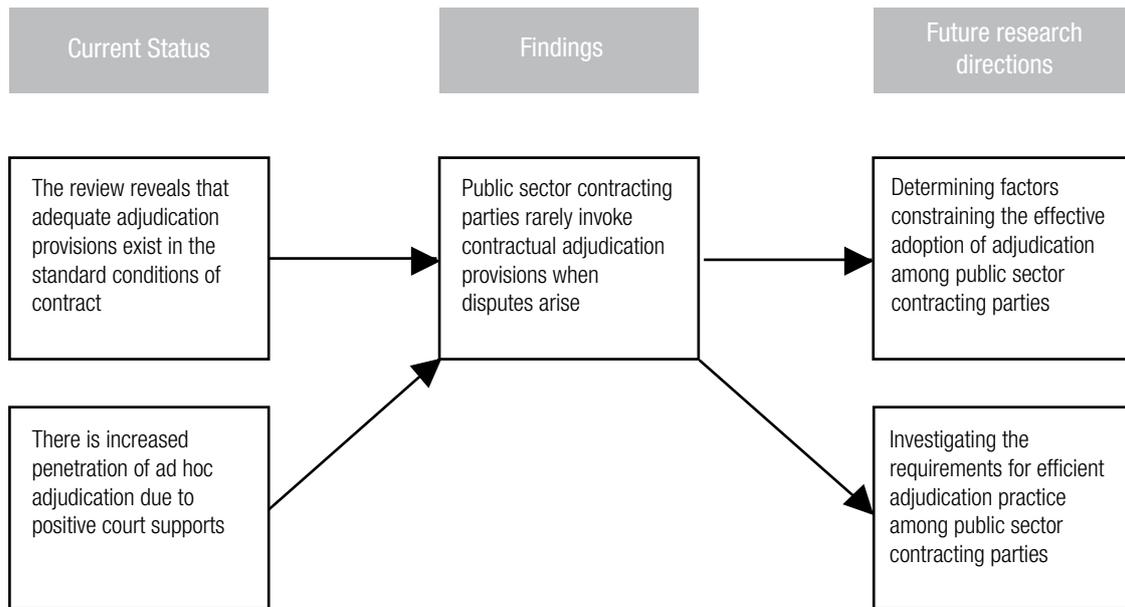


Figure 1: Current Status and future direction on adjudication practice among public sector construction contracting parties. Adapted from¹⁴.

mechanism. Therefore, the first finding of this paper is that there are sufficient adjudication provisions in the forms of contract conditions capable of mitigating dispute problems among public sector contracting parties. The second is that the public sector has to address its own constraints and confronts its limitations creatively in order to tap into the advantages of adjudication.

Lastly, the benefits and advantages of the present contractual adjudication and the proposed statutory adjudication can only be fully realized provided that adequate consideration is given to the special circumstances and limitations surrounding public sector contracts. These findings have thus necessitated the need for further research on how to implement statutory adjudication of disputes effectively on public sector projects.

REFERENCES

- 1 Department of Public Works, (1998) The Green Paper on "Creating an Enabling Environment for Reconstruction, Growth and Development in the Construction Industry", Prepared for the Minister of Public Works, Government Printing Works, Pretoria South Africa.
- 2 Harmon, K. M. J. (2003) Effectiveness of Dispute Review Boards, *Journal of Construction Engineering and Management* 129, 674-679.
- 3 Kumaraswamy, M. M. (1997) Common Categories and Causes of Construction Claims, *Construction Law Journal*, 13 (1), 21-34.
- 4 Cheung, S. O., Suen, H. C. H. and Lam, T. (2002) Fundamental of Alternative Disputes Resolution Process, *Construction Journal of Construction Engineering and Management* 409-417.
- 5 Cheung, S. O. and Pang, K. H. Y. (2013) Anatomy of Construction Disputes, *Journal of Construction Engineering and Management* 15-23.
- 6 Lynch, P. (2011) "HGCRA: Re-addressing Balance of Power between Main Contractors and Subcontractors? available at <http://www.nadr.co.uk/articles> , Downloaded on 8th October, 2015.
- 7 Cheung, S. O. and Yiu, T. W. (2006) Are construction disputes inevitable? *IEEE Transaction on Engineering Management*, 53 (3) 456-170
- 8 De Oliveira, M. (2011) The management of construction agreement in South Africa, CIB commission meeting in Law in Dispute Resolution in conjunction with international conference COBRA, Manchester (UK), Royal Institute of Chartered Surveyors RICS 267-272.
- 9 CETA, (2008) Construction Education Training Authority "Overview of construction sector, construction education and training authority" <http://www.ceta.org.za>
- 10 Maritz, M. J. (2007) An investigation into the Adjudication of Disputes in the South African Construction Industry, Conference proceedings of RICS COBRA CONGRESS September 2007, Atlanta USA 419-426
- 11 Thumbiran, I. (2015) Summary: Prompt Payment, A paper presented to adjudication delegates at the University of Pretoria
- 12 Department of Public Works, (1999) The White Paper on 'Creating an Enabling Environment for Reconstruction, Growth and Development in the Construction Industry', Prepared for the Minister of Public Works, Government Printing Works, Pretoria South Africa.
- 13 Bowen, G. A. (2009) Document Analysis as a Qualitative Research Method, *Qualitative Research Journal* 9 (2) pp. 27-40

- 14 Olanipekun, A. O. (2015) Successful Delivery of Green Building Projects: A Review and Future Directions, *Journal of Construction* 18 (1) pp. 30-40
- 15 CIDB, 2012, Construction Industry Development Board Annual report 2011/2012
- 16 CII (2007) The cidb Construction Industry Indicators Summary Results
- 17 CII (2008) The cidb Construction Industry Indicators Summary Results
- 18 CII (2009) The cidb Construction Industry Indicators Summary Results
- 19 CII (2010) The cidb Construction Industry Indicators Summary Results
- 20 CII (2011) The cidb Construction Industry Indicators Summary Results
- 21 CII (2012) The cidb Construction Industry Indicators Summary Results
- 22 CII (2013) The cidb Construction Industry Indicators Summary Results
- 23 CII (2014) The cidb Construction Industry Indicators Summary Results
- 24 CIDB, (2013) Sub contracting in the industry
- 25 Maiketso, N. C. & Maritz, M. J. (2009) What are the requirements for the South African construction industry to fully utilize adjudication? In *Proceedings of RICS COBRA Research Conference*, pp. 1556-1567
- 26 HGCRA, 1996, Housing Grant Construction & Regeneration Act, 1996
- 27 Gaitskell, R. (2007) International statutory adjudication: its development and impacts, *Management and Economics*, 25 (7) 777-784.
- 28 Kennedy, P., Morrison, A. and Mline, D. O. (1997) "Conflict between Main Contractors and Sub-contractors: The resolution of Disputes arising from the application of Set off", *Construction Management and Economics*, 15 (6), 527-537.
- 29 Kennedy, P. Miligan, J, Catttanach, L. and McCluskey, E. (2010) The Development of Statutory Adjudication in the UK and its Relationship with Construction Workload. COBRA proceedings of The Construction, Building and Real Estate Research Conference of the Royal Institute of Chartered Surveyors
- 30 Hill, T. and Wall, C. J. (2008) Adjudication: Temporary Binding and Tiered Dispute Resolution in Construction and Engineering: Hong Kong Experience.
- 31 Massey, E. (2014) Adjudication is working well in South Africa. *South African Builder* 34-36.
- 32 Hattingh, V. and Maritz, M. J. (2014) Adjudication: The South African Experience to Date. *South African Builder* 35-36.
- 33 Du Preez, O. and Verster, B. (2013) ADR Practice in the Construction Industry: a futuristic perspective, in *proceeding Law and Dispute*, International Council for Research and Innovation in Building and Construction 13-24.
- 34 Van der Merwe, C. J. (2009) Is adjudication a better procedure for construction disputes resolution than mediation? Unpublished dissertation submitted for the degree of BSc (Hons) (Quantity Surveying), University of Pretoria, Faculty of Engineering, Built Environment and Information Technology.
- 35 Bvumbe, C. and Thwala, D. W. (2011) An exploratory study of Dispute Resolution Methods in South African Construction Industry, *International Conference on Information and Finance* 21, 32-36.
- 36 CIDB, 2008, Construction Industry Development Board Indicators Summary Results
- 37 CIDB, 2012, Construction Industry Development Board Indicators Summary Results

USING RISK MANAGEMENT IN THE RE-DESIGN PROCESS FOR RE-USE OF EXISTING BUILDINGS

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PURPOSE: This paper aims to develop a framework to incorporate Risk Management (RM) into the design process as an approach towards reducing risks associated with building adaptive reuse.

ABSTRACT

Purpose

This paper aims to develop a framework to incorporate Risk Management (RM) into the design process as an approach towards reducing risks associated with building adaptive reuse.

Methodology

To achieve the aim a research methodology is designed to achieve four objectives.

- Reviewing literature related to the design process, adaptive reuse of buildings, RM and flexible design.
- Presenting and analysing three case studies to investigate the opportunities and risks associated with adaptive reuse.
- Investigating the perception and application of RM's incorporation into the design process as an approach for reducing risks associated with adaptive building reuse.
- Proposing a framework to facilitate the integration of RM into the design process.

Findings

There are many risks associated with adaptive building reuse. However, it has been proven that adaptive reuse is a better option than demolition. To minimize risks associated with adaptive reuse, RM needs to be incorporated in the design process.

Keywords

Risk Management, Design Process, Flexible Design, Building Adaptive Reuse, Office Buildings.

INTRODUCTION

Many projects are at risk that the long term demand for them will change, meaning that the function of the building will no longer be beneficial to the society; therefore its function will need to change for its lifecycle to continue. This re-use of buildings costs both time and money and has a structural risk. This needs to be considered by applying risk management early in the design phase. By considering the risks in the future, a flexible design will help in minimizing the long term risks by allowing for efficient and effective adaptive re-use of the building.

The design process is concerned with delivering projects that satisfy clients' needs and users' requirements. Risk management is usually used to identify and analyse the risks that may affect the construction of the project and therefore, develop proper response to mitigate their impacts ¹. Due to the dynamic nature of the business environment, clients' needs and users' requirements may change over the time and the project is no longer beneficial to them. This necessitates demolishing the project or reusing it with its existing structure in order to extend its life cycle while performing a new function ². Although, adaptive reuse of buildings is a widely adopted practice worldwide, it's a costly and time consuming process that is associated with a multitude of risks. Literature review showed that futuristic risks resulted from changes in clients' needs and users' requirements is not commonly considered during the design process. Adopting a flexible design approach that considers futuristic changes will help in minimizing the long term risks by allowing for efficient and effective adaptive reuse of projects ³. This paper aims to develop a framework that incorporates RM into the design process as an approach towards reducing risks associated with building adaptive reuse.

LITERATURE REVIEW

The Design Process

The phases of the design process according to Royal Institute of British Architects are 4:

1) Preparation

- Identify the needed to develop initial project brief.
- Examine site information
- Prepare feasibility study
- Determine Client's risk profile, agree on project programme.
- Assemble project team

2) Concept Design

- Outline of proposed project strategies.
- Agree on initial project brief and develop a final one.
- Review procurement strategy, finalize design responsibility.
- Prepare project manual and construction strategy.

3) Develop Design

- Prepare developed design.
- Prepare and submit planning application.
- Implement control procedures for change.
- Review construction strategy.

4) Technical Design

- Technical design information.
- Performance specified work, integrate specialist subcontractor.
- Prepare building regulations submission.
- Review construction strategy.

5) Specialist Design

- Progress specialist design by subcontractors.
- Take actions for procurement strategies or building contract.

Adaptive Reuse of Buildings

Definition and importance

"Adaptive reuse" is the process of modifying and adapting obsolete buildings to perform a new function⁵. It is generally about reusing a building with its existing structure to extend its life cycle whilst performing a new function. This is currently practiced worldwide, specifically when the building has a unique architectural character and still in stable condition⁶. The extension of building's life cycle has many downsides as it causes various technical problems when reuse is considered. Technical changes need a very high level of renovation and refurbishment. In most cases this requires the involvement of innovative solutions that can be undertaken despite the range of constraints that are faced by both the design and construction teams. Experience shows that adaptive reuse avoids the demolition of old buildings that still have energy embedded in them as demolition is a waste of resources and the cost of re-constructing is very high⁵.

Benefits and Barriers of Adaptive Reuse

The benefits of adaptive reuse of buildings are 6:

- Less use of resources, energy and emissions.
- Expanding the life cycle of buildings.
- Increasing the cost effectiveness.
- Recovering energy embodied in buildings over a large period of time.
- Giving value to resources of the community from properties that are not productive.

- Stimulating vacant neighborhoods.
- Decreasing consumption of land and urban slump.
- Giving a better aesthetic appearance to the built environment.
- Enhancing the demand for preserved existing buildings.

However, Adaptive reuse has its barriers as follows 6:

- The assumed perception that adaptive reuse of existing buildings is more expensive and less creative than new construction.
- Economic benefits are not clearly explained to by clients.
- Extensive and costly maintenance and refurbishment required for obsolete buildings can't match with new buildings performance and meet sustainability standards.
- Difficulty with availability and price of matching existing materials; and inability to maintain the structural integrity of older buildings.

Risk Management

Risk and Risk Management

"Risk" is the possibility of a threat to occur and cause damages, which can be avoided by using preventive actions. The two main features of risk are the chance of a certain hazard to occur and its consequences that will in turn have an impact on other aspects of the project. RM is a process used to identify, assess and prioritize risks of different types. Accordingly, the risk manager must start planning for the minimization or elimination of the negative consequences of risk⁷.

Risk Management Process

1) Risk Identification

Risk identification is a diagnostic process in which all the potential risks that could affect a construction project are identified and investigated, thus enabling the client understands the potential risk sources at an early stage in the project life cycle. This will help clients concentrate on strategies for the control and allocation of risk¹. Different methods are used in risk identification. They are brainstorming, historical data, checklist, tree diagram, and influence diagrams^{1,8}.

2) Risk Analysis

Risk analysis aims to evaluate risks and ascertain the importance of each risk to the project, based on an assessment of the probability of occurrence (Likelihood) and the possible consequence of its occurrence (Severity). Risk = Likelihood x Severity Loss/Gain¹. Risk analysis assesses both the effects of individual and combined risks on the project objectives. Risk analysis provides a project risk profile that the client can use to look ahead to possible future events and see the probability of those events to occur. The client can then decide whether or not to invest in the project, or adopt specific strategies for dealing with the major risks. Two techniques are used for risk analysis namely, quantitative risk analysis and qualitative risk analysis^{9,10}.

3) Risk Responses

As all projects are unique and risks are dynamic throughout the project life cycle, it is necessary to formulate a risk response strategy. The information gained from the identification and analysis of risks gives an understanding of their likely impact on the project. This enables an appropriate response to be chosen. Typically there are three main types of responses to risks: to avoid or reduce the risks, to transfer the risks or to retain the risks^{1,9}.

Risk Avoidance or Reduction

This strategy is usually performed during the earlier stages of the project, which allows the client to take a preventive action to avoid or reduce risks as early as possible. Rejecting a proposal is an obvious way of avoiding risks. Other approaches include detailed design review, further geographical / geotechnical investigation, more detailed study of the project environment, the use of alternative contractual agreement, closer co-ordination with the project team or the application of different technology or construction method ^{1,9}.

Risk Transfer

This strategy involves transferring the risk from one party to another, without changing the total amount of risk in the project. Risk transfer can occur between the parties involved in the project or between one party and an insurer. The decision to transfer or allocate risk to another party is implemented through an insurance policy or the conditions of contract. There are several factors that need to be considered before any risk transfer. First, the capability of the party whom the risk is being transferred to manage the risk and accept the consequences of risk transfer. Second, consideration is whether or not the risk premium that would have to be paid for the transfer of a risk is greater than the cost of the consequences ^{1,9}.

Risk Retention

In some situation the only option available is to retain a risk. The party that is holding a risk might be the only one that can manage the risk or accept the consequences. It is normal for the client to be left with some risks and these are termed residual risks ^{1,9}.

Risks of Adaptive Reuse

1) Endangering authentic fabric

The core principle of adaptive reuse is to conserve the authentic pattern of the building, however this can be threatened. During the process of adaptive reuse, internal and external changes are made to the building. These changes could be intentional or unintentional. The intentional changes are made as a sacrifice for adapting the building to a new function, while unintentional changes are those due to errors during the planning and execution phases as a result of wrong site interpretation.

2) Economic obstacles

The requirement for conservation usually increases the cost of construction and operation. Moreover, the cost of maintenance of any old building is high no matter how the refurbishment is adequately done. Conservation of sites located in cities with massive pressure of redevelopment and high land prices has a high cost. A heritage consultant stated that adaptive reuse is a very expensive investment, if people only count the economic return and overlook the intangible non-economic values ¹¹. Other economic obstacles include the low revenue and high energy cost of obsolete buildings and unavailability of materials required for conservation ¹².

3) Functional disorder

There is nothing that will ensure that the adapted building will meet the requirements of the new function it needs to perform. As the building typology of buildings built hundred years ago will make it hard to perform functions in the existing spatial configuration. There are also some restrictions regarding changes in layout and to be minimum. However, they will not be satisfactory to users as it will not meet their needs. This explains why design adaptation has many problems during its operation, specifically in adoptions that have a large and medium scale ¹¹.

4) Environmental impacts

The amount of contribution of old buildings to the surrounding townscape is usually neglected. Therefore, it is not necessary that the adapted building contributes to the improvement of the external environment. Furthermore, the appearance is another factor to be considered as it may not be enhanced, and also the energy efficiency of the building might decrease. Also the compatibility of the use with the surrounding buildings might not be suitable, as the adapted building may have a different density, nature and produce more waste. Mostly the environmental aspects of adaptive reuse are related to the efficiency in energy consumption and the performance of the building ¹¹.

5) Technical and legal difficulties

The extent to which the adaption procedure will overcome the lack of good performance is not guaranteed. This is because some buildings might have defects that are difficult to resolve and will cost a lot. It is hard for some old buildings to fully comply with the new building regulations. Some constraints may concern construction and cause lack of accessibility to the public. Moreover, the standards used nowadays by designers are greatly different than those used long time ago. This may cause many obstacles to the adaptive reuse of buildings. Planning is also an issue that will rise, as the land use in the area is specific for a function and cannot be changed, this restraint will act as a limit to the adaptation of the building. Other constraints include license requirements along with planning requirements in order to get approved by the concerned authorities ¹¹.

6) Conflicting stakeholders' interests

The process of adaptive reuse is interdisciplinary, therefore it is dynamic, interesting and complicated. The stakeholders of the adaptive reuse process are those who spend their time, knowledge and resources on it. Some of them are clients, local community, developers, government officials, architects, contractors, engineers, planners and specialists in historic preservation. Coordination between the stakeholders during the various stages of the process with the different elements is vital and cannot be avoided. This can cause the process to be a potential nightmare, as it is hard to coordinate people to do the correct tasks at the given time. However, the lack of coordination and suitable communication between the stakeholders may cause delays and the process will not be completed on time ¹¹.

7) Social considerations

There are many circumstances where the adaptation of old buildings raise many objections about the appropriateness of the new function to the existing community. Usually financial aspects are given more attention than social aspects. Redevelopment on the large scale usually creates a new touristic attraction when it comes to heritage buildings. Uncontrolled social changes are caused by gentrification and upgrading of projects. The correct balance in social diversity is a very important aspect; however it is usually overlooked by the rules and regulations. On the other hand, adaptive reuse projects that are on a small scale do not have an effect on the social life of the community ¹¹.

8) Losing sense of place and identity

Most clients are mainly concerned with the profit they will gain from changing the function of their obsolete properties to meet the market demand. However, the extent of the change might cause the building to lose its historical origin and identity. Some buildings that are adaptively reused only have their external skin left intact, where the sense of place inside it is completely destroyed. Due to the difficulty in tracing the connection of the place to the people living in, users prefer keeping the building as it is and are against the concept of adaptive reuse as well as the concept of renovation ¹¹.

Design Flexibility

Definition of Flexibility and Adaptability

Flexibility is mainly assumed to be responding adaptively to uncertainty regarding the environment. To be more specific, it is the extent to which a system can react and change with the minimum period of time, cost and performance loss. Therefore, it may be considered as designing a system proactively and not a system that has a reactive behavior. Adaptability has also been defined as the ability and flexibility as the competence. As capabilities are extracted from competences, adaptability is derived from flexibility¹³.

Forms of flexibility

A building is usually needs to offer two fairly diverse forms of flexibility namely modifiability and service flexibility. Modifiability mainly focuses on the ability of a building to adapt to any change that may occur throughout its life cycle. Service flexibility has to do with the capability of a building to operate with different uses and functions according to the changing needs of the society.

This type of flexibility can be enhanced in the design stage of the project. This can be done through different ways such as spaces with multipurpose that can be adjusted according to the need¹³.

Characteristics of a Flexible Design

A flexible building is a building that has been designed to allow easy rearrangement of its internal fit out and arrangement to suit the changing needs of the occupants. Adaptability is capable of different social uses and flexibility as capable of different physical arrangements. The following definitions are used:

- Adaptable building is a building that has been designed, constructed and maintained with thought of how it might be easily altered to prolong its life, for instance by addition or contraction, to suit new uses or patterns of use.
- Flexible building is a building that has been designed to allow easy rearrangement of its internal fit out and arrangement to suit the changing needs of occupants¹³.



Figure 1 : Building Before and After conversion¹⁴.

CASE STUDIES

Case(1) Adaptive reuse of 15 buildings in the Netherlands

This case study discusses the adaptation of 15 office buildings to housing buildings in Netherlands. These buildings were constructed during the period between 1999 and 2011 (see figure 1). Findings showed that the main reason for their adaptation is that they were vacant office buildings and there is a tight housing market. The risks of adaptation that faced the client were:

- The specific architecture features that affect the opportunities and risks of adaptive reuse.
- The structural grid of office buildings acts as a barrier as it does not allow for the installation of partitions as there are too many columns.
- The facade, as office buildings are usually designed with a modern facade that incorporates curtain walls.

On the other hand there are a number of opportunities that support the conversion process as follows:

- The load bearing capacity of office building is an opportunity to adaptive reuse as usually office buildings are designed withstand loads higher than those of residential buildings.

- The large number of elevator shafts. In any other type of building these shafts might not all be needed therefore this is seen as an opportunity to be used for HVAC and plumbing systems.

This case proved that adaptive reuse is a better option than demolition and that it is widely used nowadays. Secondly, it showed the need for flexible designs and RM in the early stages of design¹⁴.

Case (2) Adaptive Reuse of Office Building in Massachusetts

This case study investigates the adaptation of 30-40 square foot office building into an elderly housing project. This tests the practical and financial viability of the project. Two case studies are examined, they are both located in metro-west market of Boston Massachusetts. Site issues and cost of adaptive reuse were examined along with the development and renovation criteria. The process of conversion started with examining literature about elderly housing and interviewing developers and architects associated with elderly housing. Then two prototypical office buildings were chosen for the study, one was rectangular and the other was square. They were analyzed for the suitability of the redesign from the aspects of unit configuration, location and financeability. A cost analysis was performed to compare the adaptive reuse to constructing new wooden frame buildings. Finally, the two buildings were compared to each other to identify

the ease of redesign when considering all necessary factors. Analysis showed that:

- Rectangular buildings are easier to be adapted than square buildings as they allow for proper circulation and division of rooms that allows for natural ventilation and natural lighting.
- The systems used for air conditioning. It was found that water to heat pump is better when adapting a building than variable air systems. Also having a central system that cannot be adapted to be controlled from different units acts a huge barrier.
- A building having square windows is better than having rectangular ones as square windows can be easily adapted. Lastly a general aspect is that bigger buildings are easier to adapt.



Figure 2 : Single corridor Slab and Central Core Plan ¹⁵

Case (3) Standard Adaptable Office Buildings in Netherlands

This case study first studies the cost of building new office buildings, then the cost of constructing them with enhanced elements to help ease the reuse in the future. This case study was based on a study of the legal, technical and financial feasibility of adaptable offices, aiming to respond to the following questions: "Which initial measures should be met in order to develop adaptable office buildings, and which costs and benefits are associated with these interventions?" ¹⁵.

The main focus was on two standard types of office buildings and how their transformation potential can be increased. First is the central core tower and second is the single corridor slab (see figure 2). The process followed was firstly analyzed literature review about transformation possibilities of office buildings. Then 15 expert interviews were conducted including architects, project developers, structural engineers and mechanical engineers. Then two projects developed for adaptability were examined. Adaptability was then studied according to the findings and how it can be applied to the two types of buildings.

Finally, calculating the building cost and the total initial cost of standard and adaptable office buildings. Analysis showed that:

- The building's adaptability depends on its structure and on the amount of separation between its layers.
- A set of rules concerning the construction, facade, circulation and extendibility have been studied. The main findings showed that the façade grid height should be a multiple of 1.8 meters and width of 7.2 meters.
- Another aspect concerning construction is the columns on the facade that can allow for future changes in the facade.
- Monolithic post stressed floors help in the future adaptability as they allow for making new shafts if needed.
- The central core type has the most suitable technical measures applied.

DATA ANALYSIS

Results of a survey questionnaire conducted by the authors with 20 architectural design firms in Egypt to investigate their perception and application of RM incorporation into the design process as an approach for reducing risks associated with adaptive building reuse showed that ³.

- The main driver for adaptive reuse is achieving sustainability objectives of reducing waste in materials, resources and satisfying users' needs.
- The most frequent risk is the financial risk as it is caused by all the other risks, while the most important benefit is enhancing the demand for the building.
- Adaptive reuse is a better option than demolition as stated in case studies and users are willing to use adapted buildings.
- Design flexibility can help in reducing the risks of adaptive reuse, therefore it is highly recommended.
- RM can help in improving adaptive reuse. It can be used during the planning and conceptual stage and then followed along with the design process to assess and prioritize the future risks.

A FRAMEWORK TO INTEGRATE RM IN THE DESIGN PROCESS

Findings of literature review, case studies and survey questionnaire, showed that many risks are associated with adaptive reuse. These include: financial, economic, environmental and functional along with many other risks. However, despite all the risks it has been proven that adaptive reuse is a better option than demolishing the building. Therefore, the process of adaptive reuse is most of the time vital. However, for it to be effective and efficient it must be accounted for early in the design stage of the building. This can be done through incorporating RM into the design process. This will help achieving flexible design that take into consideration futuristic changes that will take place in the future. Example of consideration include having an open plan buildings or modular building that can have its internal fit rearranged easily. Along with taking into consideration the structure system not being very rigid and allows for flexibility. Mostly focusing on applying flexibility throughout all the design aspects along with applying the principles of the RM process. As this will lead to minimizing the future risks that the building may face during the adaptive reuse process. Therefore, extending the building's life cycle and saving it from demolition in order to meet the principles of sustainability by decreasing the environmental and economic impact (see figure3).

PROCESS

OUTPUT

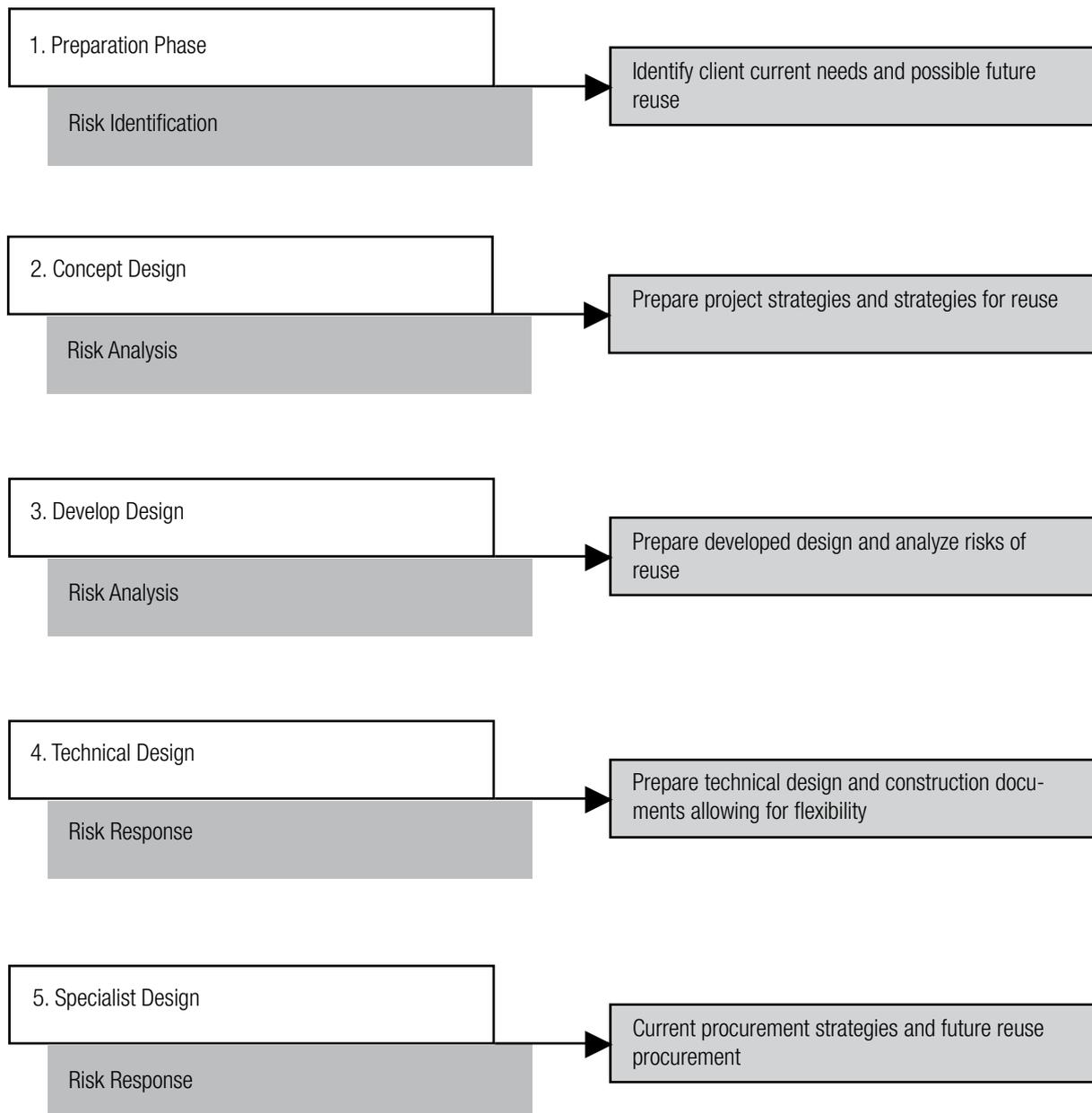


Figure 3- Framework incorporating risk management into the design process

CONCLUSION AND RECOMMENDATIONS

Having reviewed literature review and case studies and keeping in mind the results of the survey questionnaire, the research comes to the following recommendations.

Recommendations for Design Firms :

- Integrating the RM process with the design process from the beginning for it to be proactive not reactive.
- Focus on reducing the financial risks of adaptive reuse by decreasing the other types of risk that cause an increase in cost along with minimizing the time needed for adaptive reuse.
- Properly identify the market needs in the specific location as the most important benefit of adaptive reuse is enhancing the demand for the building. Therefore, the function needed by the market is what the building should be adapted to.

Applying design flexibility in the design:

- Focus on applying layers approach in the design: divide the building into a modifiable part and a permanent part.
- Have a facade that can be easily altered by using columns on the façade that accommodate for different changes.
- Use a structural grid to be used for different functions.
- Use a central core design, which has all the elevators and shafts centralized.
- Do not use heating and cooling systems that are for the whole building and cannot be controlled separately.
- Use square windows as they are easily adapted.
- Use a slab type that can allow for extra shafts to be added.
- Consider increase in the load bearing capacity.

Recommendations for the Government

The government plays an important role in enhancing the adaptive reuse process by helping in saving time needed for paper and legal work which will help in reducing the costs as the more time needed to adapt the building the more it will cost. Therefore the government needs to ease the process of getting the legal agreement for adapting a building as long as it is being adapted to a new function that will be beneficial to the community. This will lead to reducing both the legal and financial risks of adaptive reuse.

REFERENCES

1. Smith, N. J. (1999) *Managing Risk in Construction Projects*. Oxford: Blackwell Science Ltd.
2. Othman, A.A.E., Hassan, T. M., and Pasquire, C.L. (2004) Drivers for Dynamic Brief Development in Construction. *Engineering, Construction and Architectural Management* Vol. 11, Issue 4, pp. 248-258
3. Balaha, F. and Othman A.A.E. (2015). Design Flexibility as an Approach for Reducing Risks Associated with Office Building Reuse in Egypt. *International Conference on Industry Academia Collaboration*, 6-8 April 2015, Cairo, Egypt. Online Available from: https://www.researchgate.net/profile/Ayman_Othman.
4. RIBA. (2013). "RIBA Plan of work". Retrieved from: <http://www.architecture.com/Files/RIBAProfessionalServices/Practice/FrontlineLetters/RIBAPlanofWork2013ConsultationDocument.pdf>
5. Burton.B (2014). "Adaptive Reuse of commercial buildings" *Building Science Forum*, Retrieved from: <http://www.monstercommercial.com/adaptive-re-use-of-commercialbuildings/>
6. Bullen, P.A. (2007), "Adaptive reuse and sustainability of commercial buildings", *Facilities*, Vol. 25, No. 1/2 pp. 20-31.
7. Institute of Risk management. (2002). "A risk management standard" Retrieved From: http://www.theirm.org/media/886059/ARMS_2002_IRM.pdf
8. Hamilton, A. (1997). *Management in Projects: Achieving Success in a Changing World*. London: Thomas Telford.
9. Shen, L. Y. (1999) Risk Management. In: Best, R. and Valence, G. D. *Building in Value: Pre- Design Issues*. New York: John Wiley & Sons Inc.
10. Raftery, J. (1994) *Risk Analysis in Project Management*. London: E & FN SPON
11. Yung, E. H., & Chan, E. H. (2012). "Implementation challenges to the adaptive reuse of heritage buildings: Towards the goals of sustainable, low carbon cities." *Habitat International*, c36 (3), 352 – 361.
12. Danko.M, (2013). "Designing Affordable Housing for Adaptability: Principles, Practices, & Application" *Pitzer Senior Theses*. Paper 35. Retrieved From: http://scholarship.claremont.edu/pitzer_theses/35
13. Gosling, J, Naim, M, Sassi, P, Iosif, L and Lark, R (2008) "Flexible buildings for an adaptable and sustainable future". In: Dainty, A (Ed) *Procs 24th Annual ARCOM Conference*, 1-3 September 2008, Cardiff, UK, Association of Researchers in Construction Management, 115-124.
14. Remøy, H. T. & Vander Voordt, D.J.M. (2014), "Adaptive reuse of office buildings: opportunities and risks of conversion into housing". *Building Research & Information* 42:3, 381-390.
15. Hilde. R (2011). "Adaptable office buildings", *Property management*, Vol.29. Iss 5, pp.443-453.

SUSTAINABLE GRID INFRASTRUCTURE: THE CO-EVOLUTION OF SOCIO- ECONOMIC AND SOCIO-TECHNICAL SYSTEMS THROUGH MICROGRID ADOPTION

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PURPOSE: The purpose of this paper is the development of an understanding towards the notion of sustainability, so as to form a basis for challenging the classical operation of the current passive energy system in favour of one which is more dynamic, and adaptive, promoting effectiveness of individuals within the system, vs. pure system efficiency as the driver of sustainability objectives.

ABSTRACT

Purpose Of This Paper:

The purpose of this paper is the development of an understanding towards the notion of sustainability, so as to form a basis for challenging the classical operation of the current passive energy system in favour of one which is more dynamic, and adaptive, promoting effectiveness of individuals within the system, vs. pure system efficiency as the driver of sustainability objectives.

Design/Methodology/Approach:

The research combines a theoretical approach based on available literature with a case study approach focused on analytical usage data on an existing building, along with a discussion on the aggregated potential of dynamic consumers.

Findings:

Microgrid adoption was proven to be viable on technical and economic grounds. A 3.7-year payback period along with a 36.8% in energy expenditure provides a means for increased renewable adoption and enhanced consumer participation in grid sustainability.

Research Limitations/Implications:

Due to a limited time frame, theoretical values for production and future tariff increases were used.

Practical Implications:

Adoption of microgrids and renewable energy systems at the micro level affords a more dynamic energy grid with enhanced robustness and sustainability through variety of supply.

What Is Original/Value Of Paper:

The results are used to provide justification for increased focus on creating active energy users through Microgrid adoption, facilitating a change from a vertical to a more horizontal complex grid structure consisting of distributed active consumers.

Keywords:

Microgrids, Smart grid, sustainability, Complex systems, Distributed resources

INTRODUCTION

This paper builds on previous research and seeks to answer the fundamental question of whether by taking an individual centric approach, in the form of modularity of individual consumers, through Microgrid adoption, would it be possible as a result to aggregate influence on the operation of the energy system. In fact, another question is related to better fulfil the initial aims for which the system was created, that of providing energy to all parts of the systems in a sustainable manner. It is hoped to question whether sustainability as a characteristic, not an outcome, can emerge from the system and if so, how is it possible to ensure that this emergence continually tends towards sustainability for generations to come even when placed under systematic stress by external and internal variations. Introducing distributed energy sources is vital in ensuring system robustness in the long term, however this introduces variations into the system which previously were not designed for, and if left unchecked has the ability to reduce overall effectiveness of the system as a whole even in light of a scenario where individual agents become increasingly more efficient and sustainable.

No longer we are able to exist in isolation, our daily lives and our existence is a function of our immediate actions and our environment primarily consisting of those we are connected to, known and unknown, these relationships within a system hold the key to creating an adaptive effective system, able to

harness our increasing efficiency and as a consequence allow sustainability to emerge. The idea of complexity hinges around the whole resisting reductionism¹, in that its parts are unable to be studied in isolation. For the sake of this paper, the focus is on how it is possible to quantifiable facilitate and integrate individual actors within the system in order to induce complex properties and adaptations.

Using Agent based modelling principles and theory, it is hoped that a discussion on what is possible will stimulate thoughts on our current system. An in-depth generation of a working model is beyond the scope of this paper; however, this paper will serve as a stepping point to further studies and discussion on more in-depth real world complex scenarios. In Systems theory the patchiness principle refers to the notion that system instability is as a result of a systematic lack of capacity to use a variety of resources². Our current rigidly centralised hierarchical system is that exact inability which the patchiness principle refers to, as Richardson's neatly sums up

*"... to maintain a level of stability in the face of changing conditions a system should not invest too much time and effort into one particular way of doing things"*³.

A capacity to take advantage of a plurality of resources allows the system to *"move with the times"*. Our inability to transition from our current mind-set of being purely energy consumers with a right to energy, to that of being active participants in the supply in the form of prosumers, will inhibit transition to a grid structure which is more resilient to negative events and will fundamentally inhibit the effectiveness of renewable energy production and as a consequence the achievement of a sustainability in the long term.

BACKGROUND

If we succeed in creating sustainably effective individual consumers through Microgrid adoption, we would have only partially realised the true potential of intelligent individuals and their role within the newly created systems. If these intelligent agents are structured within an intelligent network, so that there is autonomous interaction with upper levels (vertical and horizontal) of the hierarchical energy system, as well as with the connected consumers, then this intelligent network has the characteristic ability for being amongst others: self-supporting, adaptive, active, cost-effective, eco-friendly but, above all, secure and stable. This final part of this investigation deals with theoretically creating a horizontal structure within the energy grid, where an enhanced consumer plays a central role. The justification for a more horizontal grid structure is as a result of the substantial aggregation effect of building consumption, and in theory the potential energy production potential inherent within the horizontal structure in the form of an aggregation of individual building energy production and savings. This horizontal structure is the corner stone of an intelligent/smart grid; however this system is one system within the confines of a "system of systems" from the weather system which impacts the energy system, to the social behaviour of the individual interacting with the energy system creating emergent challenges which need to be accounted for when designing or restructuring the energy system for the future. This redesign in the form of horizontal structure creates an increase level of complexity that, when embraced, has the potential to enable sustainability to emerge⁴.

RESEARCH CRITERIA AND METHODOLOGICAL APPROACH

This paper is aimed at critically analysing the existing vertical model towards energy supply and sustainability through a theoretical approach based on the current literature review and a conceptual case study developed in Durban (South Africa). Formulating the framework for which a complex multi-agent and horizontal model can be adopted through the establishment

of modular microgrids, embracing the inherently dynamic environment in which energy supply and subsequent use exists within. The literature review in the research phase dealt with providing an alternative through the development of a complex system characteristic, embracing behavioural characteristics and traditional economic principles, cultivating coordination within the framework of a higher knowledge base allows for previously segregated and isolated agents to effectively contribute to their own sustainability, as well as the collectives through their enhanced participation in grid security and supply. This knowledge was incorporated into the case study and was used to provide justification for Microgrid adoption through consultation with eThekweni electricity. Moreover, relevant renewables resources in the form of Solar PV, was adopted due to its flexibility and ability to be installed in incremental capacities and in modules. Building energy Data was captured by installing (temporarily) a meter to execute an energy audit. The findings were then correlated and aggregated through theoretical discussion on multiple system adoptions across a broad range of similar buildings, particularly with a focus on the ability to replace traditional centralised supply with distributed resources, facilitated by private individual consumers, who have been granted an enhanced role in grid supply though increased autonomy and individual responsibility.

THE CASE STUDY: One System Making A Difference, Evolution Of The "Durban Power Grid"

Why is there a need for developing microgrids? The answer was found lying in two specific areas most applicable to the average building user. (1) Economic and (2) Behavioural. The architecture of a system as Whitney (2006) highlighted, has the ability to either determine or influence the behaviour and property of system⁵. Adopting microgrids alters the structure and, thus, the dynamics of the Microgrid system itself and by extension the broader interconnected systems.

Economic justification

The current supply model existing in Durban, has the municipality as the sole supplier and biller of energy to the end user. This exposes the end-user to various charges involved in the supply and use of that energy. The primary charge (above the energy cost) being a 22.5% voltage surcharge to step the voltage supply down from 11kVA to a usable 400v. That surcharge is calculated on the total bill (including all network demand charges) this charge is as a result of equipment cost and maintenance. With around 35% of the total energy costs being related to supply charges above actual electricity costs, this is an area that is often overlooked in energy efficiency measures as it does not provide any direct environmental benefit and investment does not provide any production capacity.

The new proposed model (as outlined in fig 2) has the municipality as the bulk supplier, and the end-user as the secondary supplier and provider of energy to the separate sub meters in the building that supply the tenants. This has numerous advantages. First of all, an immediate reduction in monthly electricity bills of 12%, in itself would be sufficient to justify an investment. Secondly, the building owner can actually become a supplier of electricity; this allows the owner to take advantage of the two different pricing structures. Supply is at T.O.U tariff, while sub supply is at B.N.G. This allows the building owner to in essence charge a premium of on average 25c per kWh for the sub meters. Thirdly, the adopted solar plan has the effect of allowing the building owner to take advantage of the lower T.O.U tariff, while receiving payback from the solar electricity at the higher B.N.G rate. This provides greater flexibility and predictability for income from a solar retrofit and battery storage adoption, reducing overall risk and increasing the probability of sustainability.

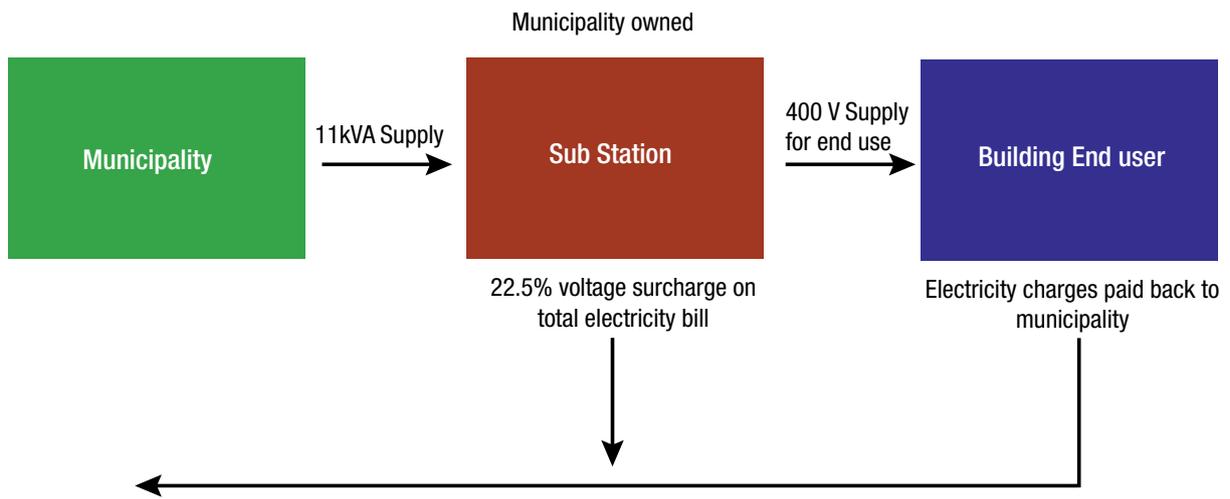


Figure 1 : Current Grid connection

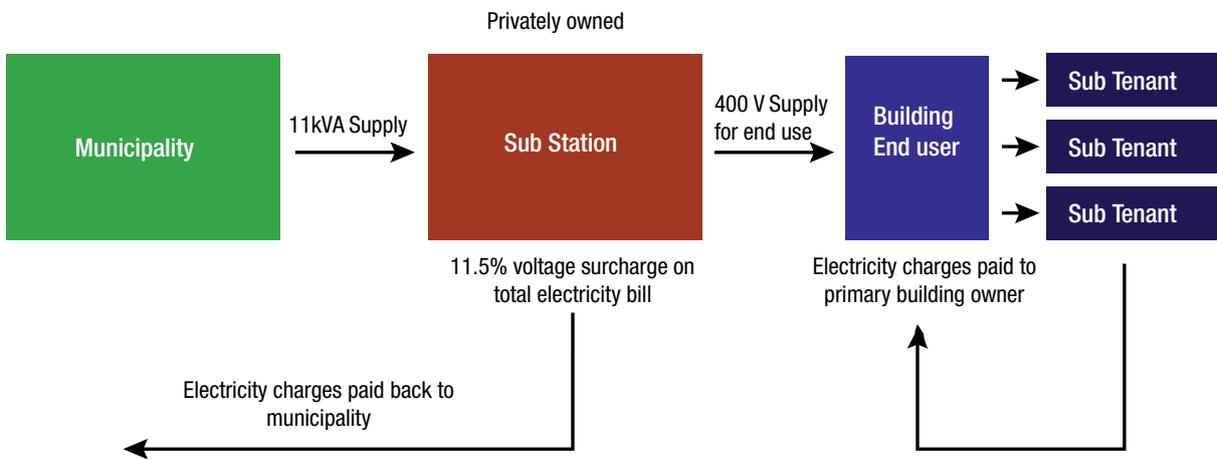


Figure 2 : Proposed Model

Voltage Surcharge	
Voltage	%Surcharge
275kV	0.00
132kV	2.25
33kV	3.00
11kV	10.50
6.6kV	12.75
400 V	22.50

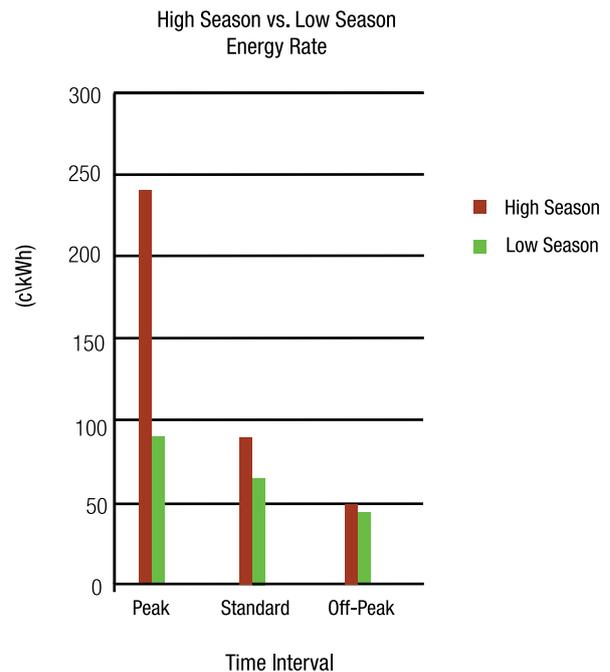


Figure 3: Voltage surcharge ⁶

With Local grid supply is via a distribution ring at 11KV. Accessing the 11KV distribution ring is reliant on the establishment of a Microgrid through the installation of a mini transformer with 11KV feed. This would, in effect, mean the building has the potential to exist as an island from the main grid in case of a system failure or if the client wished to develop a fully self-supporting system. Currently, the economic benefits of microgrids adaption are deemed the most crucial as a means of providing greater feasibility for a RES system to be developed on site. There are two components to this, if we use off-peak to charge the BESS system the energy cost is in effect 12% lower, while when we sell it (by using it at Peak periods) the energy savings are 12% higher. This is summed up on the next page in **table 1** for the system as a functioning whole.

Behavioural Justification

Security is crucial component of investment in renewable technology, by establishing the building, as a Microgrid the energy environment is partially segregated from the broader general energy environment. A Microgrid system creates a system, which is definable and has a greater degree of control then a system integrated into the broader grid system. This increased security and definable boundaries means that in the climate of current shortfalls and sustainability calls, the segregated system of a microgrids has the ability to produce, off-set and account for their individual energy system. It is this accountability, which provides the self-motivation for investing in a sustainable solution to an individual's energy system that is not solely reliant on traditional means of supply.

The results for the investigation were mixed and varied; at the beginning of the investigation the objective was to create a user that was more effective and in effect sustainable. If these are rigid objectives then either a production or storage system structure alone are not enough to satisfy the definition of sustainability.

It was found that achieving sustainability relied on a combined approach with the aggregation of the outcomes tending towards a system which is both sustainable and cost effective so as not to drive away investment potential. **Table 1** on the next page, summaries the secondary financial component of sustainability.

If we succeed in creating sustainably effective individual consumers through Microgrid adoption, we would have only partially realised the true potential of intelligent individuals and their newly created systems. If these intelligent agents are structured within an intelligent network, so that there is autonomous interaction with upper levels (vertical and horizontal) of the hierarchical energy system as well as with the connected consumers, then this intelligent network has the characteristic ability for being amongst others: self-supporting, adaptive, active, cost effective, eco-friendly and above all secure and stable. This final part of the paper deals with theoretically creating a horizontal structure within the energy grid, where the consumer plays a more central role. The justification for a more Horizontal grid structure is as a result of the substantial aggregation of building consumption, and in theory the potential energy production potential inherent within the Horizontal structure in the form of an aggregation of buildings. This Horizontal structure is the corner stone of an intelligent/smart grid, however this system is one system within the confines of a "system of systems" from the weather system which impacts the energy system, to the social behaviour of the individual interacting with the energy system creating emergent challenges which need to be accounted for when designing or restructuring the energy system for the future. This redesign creates an increase level of complexity that, when embraced, has the potential to enable sustainability to emerge ⁷.

Replicating a distributed Power plant

Is it possible to create a distributed renewable energy plant, comparable to a traditional centralised fossil fuel based plant? And if so, what exactly would it take to reproduce the production potential of a coal fired powered plant using distributed RES? And is it feasible that a virtual (virtual by nature of its separated components) renewable power plant could be a replacement for a traditional centralised power plant?

As the fourth largest coal fired power plant in the world when completed, Kusile is an ideal benchmark for comparison. Ideal due to its nature and reliance on fossil fuel for energy production, its nature as a centralised production method which is reliable in its output, yet inflexible in the nature of supply. With currents plans to build a similar size coal fired plant called "coal 3" there is a benchmark to which a RES could be justifiably compared and promoted as a viable alternative to what arguably is an outdated technology which contributes large volumes of harmful Greenhouse gases to our environment.

At 16% of total Eskom supply capacity, Kusile is a large component of our power system, with a correspondingly large negative environmental impact. Large transmission distance also equate to transmission losses of around 10% for distance > 600km from the plant itself.

The main benefits of renewable production:

1. No continual input cost to produce energy after initial capital cost and some minor maintenance costs;
2. Production occurs closer to demand resulting in less transmission losses;
3. A RES system allows for supply to match demand resulting in less off-peak wastage;
4. A RES system evenly distributes peak load reducing infrastructure requirements;
5. Sustainability is achievable as renewable resources are non-diminishing and produce zero carbon during production.

Table 2: Kusile coal power plant statistic

Size	4800 MW
Cost	118 000 million
Actual cost if operating costs included	282 000 million
Life span	60 years
CO2 produced per annum	37 Million ton
Coal used per annum	17 Million tons
Downtime	10%
Average annual production	37900GWh
% Of Eskom annual production	16%
Fuel, operation and maintenance costs Fuel, operation and maintenance costs	25%
WACC of 8% over 30 years	
Average cost/kwh produced	R1, 45

Table 1: Combined financial results of investigation

Savings from solar		1	2	3	4	5	6	7	8	9	10
Energy saved		52175	55762	59596	63693	68072	72752	77753	83099	88812	94918
Tax cost due to savings	28%	-14609	-15613	-16687	-17834	-19060	-20370	-21771	-23268	-24867	-26577
Total		37566	40149	42909	45859	49012	52381	55982	59831	63945	68341
BESS	ITOU rates	1	2	3	4	5	6	7	8	9	10
Arbitrage		133873	150607	169433	190612	214438	241243	271398	305323	343488	386424
Demand savings (R)	R76,40	77011	86638	97467	109651	123357	138777	156124	175639	197594	222293
Notified demand savings (R)	R24.13	24323	27363	30784	34632	38961	43831	49310	55473	62408	70209
Tax	28%	-65858	-74090	-83351	-93770	-105492	-118678	-133513	-150202	-168977	-190099
Total		169349	190518	214332	241124	271264	305172	343319	386234	434513	488827
Voltage savings		228000	256500	288562.5	324632,813	365211,914	410863,403	462221,329	519998.995	584998,869	658123,728
Cash flow Projections		1	2	3	4	5	6	7	8	9	10
Combined income		434915	487166	545804	611616	685488	768417	861523	966064	1083456	1215292
VAT Claim		424000	0	0	0	0	0	0	0	0	0
Depreciation		448000	268800	179200	0	0	0	0	0	0	0
Total	-2900000	1306915	755966	725004	611616	685488	768417	861523	966064	1083456	1215292
Cash Flow	-3200000	-1893085	-1137119	-412115	199500	884988	1653405	2514928	3480992	4564448	5779740
Year			2	3	4	5	6	7	8	9	10
Payback Period	3,7 Years										
IRR	28%	See Appendix									
ROI (nominal)	144%	See Appendix									

Table 3 : RES cost for Kusile sized supply

Required output	37000	GWh
Solar case study system	0,0816	1 Building
Systems to match Kusile	453432	
Cost per system	2100000	
Total cost	950 Billion	

With a life span of 60 years, Kusile will be around for an extended period of time, requiring unsustainable and environmentally harmful practices to fuel the process due to its reliance on fossil fuel inputs. When compared to this a RES at R950 Billion, may sound beyond the reach of even a comparison, particularly when the system is only guaranteed to last a period of time which is far shorter than a large coal fired plant. However, if one considers the fundamental differentiate between the two in the form of the externalities placed on society through the technology, weighting the costs, while not entirely quantifiable, are justifiable.

Table 4 : Estimated annual externality cost Kusile⁸

	Net Output	Externality Cost			
	GWh	Low (R million)	R/kWh (Low)	High (R million)	R/kWh (High)
Health	32 301	182.8	0.006	213.3	0.007
Climate Change	32 301	3 148	0.097	5 334	0.165
Water	32 301	21 305	0.660	42 357	1.311
Mining	32 301	6 538	0.202	12 690	0.393
Total		31 174	0.97	60 594	1.88
Total* excluding water for generation purposes*		9 869	0.31	18 237	0.56

A case study by Greenpeace generated the following cost of externalities, assuming the same 25 year period as solar feasibility will last, the results shift slightly closer.

Assuming the lower calculated externality cost over 20 year the societal cost would equate to 700 Billion Rand, if transmission losses are ignored but the operating, running and input costs are included, over 20 years. The actual cost of Kusile is in the region of R863 Billion, far closer to the R950 Billion required to construct a theoretical RES of comparable size able to replace Kusile. Another often ignored consideration is the direct foreign financing received for Kusile from foreign banks and investors. This investment is not-altruistic and thus requires an interest rate included in the repayments. Over 30 Years on a loan of the size taken for Kusile, the interest payment would equate to around R166 Billion rand at an assumed 8%. This in effect brings the total cost of Kusile, if repaid over 20 years, closer in the region of R974 Billion Rand, slightly above the R950 Billion a RES would cost.

While the financial justification for RES is evident, if one is to go beyond just the numbers involved, then the true potential of a distributed RES becomes evident. It is how the system is constructed that holds the greatest potential. Responsibility for construction is deferred from as single controlling entity to that of 450 000+ individual direct consumers, meaning risk is spread amongst a far greater percentage of the energy users demographic. It is this modularity and flexibility in adoption which means the total investment input is now correspondingly lower resulting in increased adoption rates and greater value for money in the long term. Sustainability being an inherently social issue is now, thus, solvable directly through a social mechanism and instead is not reliant on a centralised system driven intervention with only indirect links to the social cause of the issue.

RESULTS AND DISCUSSION

Recreating a traditional coal power plant through RES is reliant on a financial input far greater than what is feasibly possible through a single source of intervention, however when that financial cost is spread amongst the collective, and is provided by private individuals, then the goal for renewable adoption is infinitely more attainable with the collective benefiting as a whole, through a more secure and diverse grid supply which has

increasing levels of sustainability⁹. Going forward there are four areas of focus, which a particular focus is needed from a municipal point of view in order to drive adoption. Policy needs an increased focus on not just the technical but also the cognitive disposition ¹⁰ of individual consumers in the form of:

1. Increased use of a loss aversion framework. Humans are intrinsically loss averse, thus users need to be more aware of their usage and when they use energy. This is reliant on real time data and a direct link to the consequences of energy use. Merely using a TOU tariff is ineffective when the consumer assumes there is no other option. To this end based on earlier discussions of behavioural characteristics a change from post-paid TOU to prepaid TOU would enhance the loss aversion affect for the consumer as there is a direct relationship to how they consume energy. This would be facilitated through the adoption of Microgrid with enhanced grid communication in the form of real time data.
2. Opt out, not in. Sustainability will fail, if consumers in the system are able to benefit through ignoring calls, which negatively impact the individual while benefiting the collective. Game theoretic principles proved that the rational choice in the situation is selfishness in favour of personal gain. In the current grid set up this was proved to be the correct decision even with the resulting consequences being a failure in the system. Altering this is reliant on creating a system or policy, which can only be opted out of, and not merely be a system where there is a request for opting in. In effect, sustainability and renewable technology become the default option and not merely the preferred and often ignored option this theory is based on numerous studies where altering the default option greatly increased adoption rates for an option which was previously ignored.
3. Discount rates for Renewable and distributed resources need to be reduced. High costs for Solar PV will always be a barrier to wide spread rapid adoption; this requires a concerted focus on methods or mechanisms able to reduce this factor. As discussed earlier a small increase in buy back prices as well as tax incentives could address this. However more is needed to reduce pay back periods and thus the risk of investment further. A viable option would be

incorporation of the cost into building repayments or utility repayments, helping spread the original upfront cost of the system over a period of time. This, however, is reliant on government invest which perhaps is not currently available.

4. Effective design. The future energy system structure needs to be design from the perspective of the user. This includes not just the technology but the policies and mechanisms used to drive adoption of RES. Simplifying and streamlining the adoption process will make the new RES systems inherently more user friendly and decrease the consumers aversion based on pure confusion and non-clarity. Through reducing the number of factors needed to take into consideration as well as allowing more functional information to be able for the consumer to process. This has the antithesis of an increase complexity in designing the system to make it operate effectively, however the modular nature of microgrids and Distributed resources means this complexity is easily managed and an advantage in a vulnerable energy system.

By providing consumers with a platform to contribute to their own energy security, the potential aggregated consequence is improved grid security for the collective as well a system which converts effectiveness rather than one which relies on rational consumers to be more efficient at a direct cost to themselves. A system with multiple agents acting within a hierarchy that exhibits increased horizontal and not vertical structure through multiple distributed energy sources will lead to a grid which is inherently sustainable and robust ¹¹, one which is able to meet not just our current needs, but our needs in the future.

CONCLUSION AND RECOMMENDATIONS

Microgrid development was proven to be justifiable on economic grounds, reducing payback periods while providing an income potential previously not evident. This increased economic potential enables sustainability measures to be a less risky proposition for business thus enhancing the probability of success through the associated reduction in risk. A 3.7-year payback period with a reduction of 36.8% in energy bills will significantly alter the business ability to compete in light of rising energy costs in the short term this reduction of risk and decrease in payback periods can provide justification for future adoption of increased renewable production. This adoption will enable a new enhanced level of knowledge to develop within the grid and its users. This will have a corresponding increased adoption rate of RES, resulting in the single agent system with its vertical hierarchical structure being replaced with a multi agent system, which has a more horizontal and distributed structure with greater variety in supply as well as an enhanced system robustness. This reduces sustainability's success to a sum of its parts versus being reliant on the whole allowing the principle of emergence to drive sustainability in a more open and dynamic system. By providing the individual with an identity, enhanced sustainability thinking was promoted, in that actions now have direct and measurable consequences for one self as these actions not incrementally diminished or altered by the collective inaction.

Microgrid potential is clearly evident for an individual or business. However, this benefit can be extended to the collective if accurate and real-time data is used to coordinate energy usage and renewable production. Allowing seamless energy export to the grid at a higher net rate than is currently afforded will further enhance the viability for renewable production promoting higher levels of investment in renewable generation and storage. This production can be used to supplement current supply deficiencies or in the long run can be used to replace the need for further non-renewable production means. This

decentralised approach allows energy produced to be consumed in the same spatial frame, enhancing efficiency further as well as providing further incentive and control for municipalities to safe guard themselves against future shortfalls in supply. Above pure efficiency, a decentralised distributed system consisting of multiple sources creates a system which is highly effective and by extension sustainable.

Future studies need to focus on creating Microgrid communities where interests are aligned in such a way that renewable production and storage are optimised, allowing the Microgrid to exist solely using off-peak grid power while being a net energy producer in peak periods. This approach will provide energy security and financial risk reduction for the individual as well as allowing sustainability goals being achieved via a combination of individuals benefiting the collective as a whole, thus accelerating sustainability success through the use of multiple agents' actions with society being the solution to one of their greatest needs.

REFERENCES

- 1 Regenmortel, M. (2004) "Reductionism and complexity in molecular biology." *EMBO Rep*, 5(11), 1016-1020.
- 2 Skyttner, L. (2001) "General systems theory: Ideas and applications," World Scientific.
- 3 Richardson, K. A. (2005) "Systems theory and complexity: Part 3," *Emergence: Complexity & Organization*, 7(2), pp. 104-114.
- 4 Hitchens, D. (1992) "Putting systems to work". Chichester, Wiley.
- 5 Whitney, D. (2006) "Advanced System Architecture" pp.23-55.
- 6 Ethekwini electricity, (2014). "Ethekwini electricity annual report. [online]" 32-41.
- 7 Oliver J, Kipouros T, Savill M. (2015) "Configuring an electrical power network with distributed generation by multi-objective optimization with evolutionary computing." *Emergence: Complexity & Organization*.
- 8 Åslund, C. (2012) "The True Cost of Coal in South Africa - Paying the price of coal addiction." *Greenpeace*, pp.1-9.
- 9 Pool, R. (1997). "Beyond engineering: How society shapes technology." New York, Oxford University Press.
- 10 Tversky, A and Kahneman, D. (1989). "Rational choice and the framing of decisions." *The journal of business: The behavioural foundations of economic theory*, 59 (4), 251-254.
- 11 Richardson, K. A. (2004b). "Systems theory and complexity: Part 2," *Emergence: Complexity & Organization*, 6(4): 77-82.

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The paper should be written and arranged in a style that is succinct and easily followed. An informative but short title, a concise abstract and keywords and a well-written introduction will help achieve this. Simple language, short sentences and a good use of headings all help to communicate information more effectively. Discursive treatments of the subject matter are discouraged. Figures should be used to aid the clarity of the paper. The reader should be carefully guided through the paper.

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The manuscript must be in English, typed and double-spaced 10-pt type on one side of A4 paper only, with a 4cm margin on the left-hand side. All other margins are to be 3 cm. All text should be linked to the left and right margins i.e. paragraphs should not be indented and text should be justified. One-line spacing should be left between paragraphs and double line spacing before a new heading.

Leave one line space between a heading and the following paragraphs. All headings should be in 12pt bold capitals. Paragraphs and sub-paragraphs should not be numbered.

The pages should be numbered consecutively. There should be no loose addenda or notes or other explanatory material. The manuscript should be arranged under headings and sub-headings.

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The first page of the manuscript must contain a concise and informative title, a secondary running title of not more than 75 characters and spaces, the name(s), the affiliation(s) and address(es) of the author(s) and the name, address, telephone, fax and email of the author who will be responsible for correspondence and corrections.

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Discussion:

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Acknowledgements:

A short acknowledgement section of one paragraph is permissible at the end of the text.

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Tables should only have horizontal lines, the heading and bottom lines being in bold. All words should be in upper and lower case lettering. The headings should be aligned to the left of their column, start with an initial capital and be in bold. Units should be included in the heading. Any explanations should be given at the foot of the table, not within the table itself.

Table 1 : Component expenditures

Component	Expenditure (%)
Cleaning Works	25
Mechanical Services	25
Building Works	25
Civil Works	25
Total	100%

(Northwood, 1995)

Symbols, abbreviations and conventions:

Symbols, abbreviations and conventions in papers must follow the recommended SI units. Where non-standard abbreviations are used, the word(s) to be abbreviated should be written out in full on the first mention in the text, followed by the abbreviation in parentheses.

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- 1 Bon, R. (1997) "The future of international construction." *Building Research and Information* 25, 137-41.
- 2 Stone, P.A. (1980) *Building Design Evaluation: Costs-in-use*. E & FN Spon, London.
- 3 Barrett, S. (1981) "Implementation of public policy." In *Policy and Action*, Barrett, S. and Fudge, C. (eds), Chapman & Hall, London, 1-33.

If no person is named as the author the body should be used (for example: Royal Institution of Chartered Surveyors (1980) *Report on Urban Planning Methods*, London.

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THE BUILT ENVIRONMENT: TOWARDS A RENNAISSANCE

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