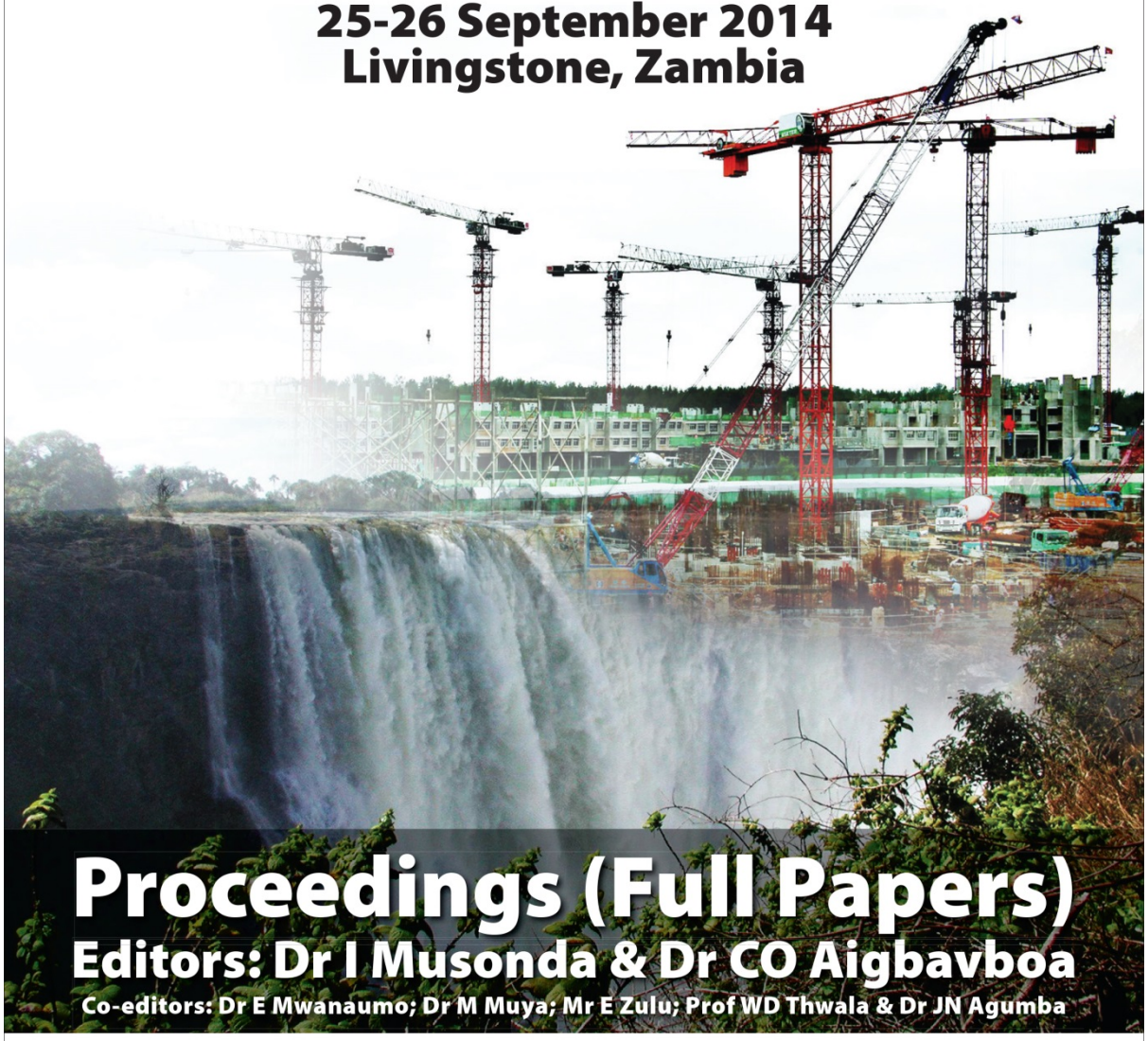
PROCEEDINGS OF THE INTERNATIONAL CONFERENCE ON INFRASTRUCTURE DEVELOPMENT AND INVESTMENT STRATEGIES FOR AFRICA

DII – 2014

25-26 September 2014
Livingstone, Zambia



Proceedings (Full Papers)

Editors: Dr I Musonda & Dr CO Aigbavboa

Co-editors: Dr E Mwanaumo; Dr M Muya; Mr E Zulu; Prof WD Thwala & Dr JN Agumba

NCC National Council for Construction

Copperbelt University

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DII – 2014

DECADES OF INFRASTRUCTURE INVESTMENT

An International Conference on Infrastructure development and Investment strategies for Africa

Editors

Dr Innocent Musonda

Dr Clinton Aigbavboa

University of Johannesburg, Johannesburg, South Africa

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Dr E Mwanaumo, Dr M Muya, Mr E Zulu, Prof. WD Thwala & Dr JN Agumba

University of Zambia, Copperbelt University Zambia & University of Johannesburg, Johannesburg, South Africa

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FOREWORD

On behalf of the Local Organising Committee (LOC), it is my pleasure to welcome you to Livingstone, Zambia, the host city of the International Conference on Infrastructure development and Investment strategies for Africa – DII – 2014. The 2014 conference aims to provide an international forum where leaders, engineers, researchers, practitioners and other stakeholders in infrastructure development, civil engineering the general built environment can discuss, and evaluate the impact of infrastructure spend on Africa. It is hoped that presentations at the conference will be able to inform policy formulations across Africa. The broad topics covered by the conference include:

- Infrastructural development and finance
- Environment, safety and Health considerations in infrastructural investments
- Construction procurement
- Regenerative sustainability
- Skills development, transfer and empowerment
- Appropriate construction technology
- Development and Growth infrastructure
- Contractor development
- Appropriate design and development
- Sustainable development
- Infrastructure delivery and investment returns
- Effective infrastructure development strategies
- Integrative infrastructure development planning
- ICT in infrastructure development
- Social infrastructure development

Warm gratitude is extended to the authors who have successfully gone through a two-tier peer review process in order to have their papers accepted and published in this proceeding. The peer review process would have been impossible without the support of the members of the Scientific and Technical Committee (STC). The LOC is thankful for this voluntary service that is central to the quality of accepted papers.

Special thank you also goes to all the conference delegates that have travelled from as far as Australia and other continents. Thank you for attending the event and please make the most of your time at the conference while enjoying the hospitality of the people of Livingstone, Zambia.

Dr Innocent Musonda

Livingstone, Zambia

25 September, 2014

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The LOC of the International Conference on Infrastructure development and Investment strategies for Africa – DII – 2014 is grateful to the University of Zambia, Copperbelt University, Zambia, University of Johannesburg, South Africa, National Construction Commission, Zambia, Construction Industry Development Board, South Africa, the Chartered Institute of Building, South Africa and Zambia, Africa and International universities for supporting the conference through their valued contributions.

The contributions and unique support of the International Advisory and Scientific Committees, who worked assiduously to prepare refereed and edited papers, which produced this published proceedings that is of the highest standard in terms of satisfying the criteria for subsidy by the South African Department of Higher Education and Training (DHET), is truly treasured. The contributions of Dr Mundia Muya, Mr Ephraim Zulu, Mrs Sadi Seyama, Dr Justus Agumba, Prof Didibhuku Thwala, Dr Innocent Musonda, Dr Clinton Aigbavboa and Dr Erastus Mwanaumo are recognised. The support of Mr Ansary Nazeem, Prof Dundu Morgan, Mrs Chioma Okoro, Mr William Morena is also laudable.

DISCLAIMER

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DECLARATION

All the papers in these conference proceedings were double-blind reviewed at abstract and full paper stage by the members of the International Scientific Committee. This process entailed detailed reading of the abstracts and papers, reporting of comments to authors, modification of papers by authors whose papers were not rejected by the reviewers, and re-evaluation of revised papers to ensure quality of content.

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THE PEER REVIEW PROCESS

The need for high quality conference proceedings as evident in the accepted papers while complying with the requirements for subsidy of the South African Department of Higher Education and Training (DHET) necessitates a rigorous two-stage peer review process by no less than two acknowledged experts in the subject area. In this context, submitted abstracts were twice blind reviewed.

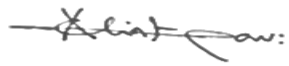
Authors, whose abstracts were accepted were provided with anonymous reviewers' comments and requested to submit their full papers noting and addressing these comments. Evidence was required relative to the action taken by authors regarding the comments received. The abstracts and resubmitted papers were twice blind reviewed in terms of:

- Relevance to conference theme and objectives;
- Originality of material;
- Academic rigour;
- Contribution to knowledge;
- Research methodology and robustness of analysis of findings;
- Empirical research findings, and
- Critical current literature review.

Authors whose papers were accepted after this second review were provided with additional anonymous reviewers' comments and requested to submit their revised full papers. These final papers were only included in the conference programme and the conference proceedings after evidence was provided that all comments were appropriately responded to. At no stage was any member of the International Scientific Committee, the editor or the co-editors of the proceedings involved in the review process related to their own authored or co-authored papers.

The role of the editors was to ensure that the final papers incorporated the reviewers' comments and arrange the papers into the final sequence as captured on the USB memory stick and Table of Contents. Of the 48 abstracts originally received, only 35 papers were finally accepted for presentation at the conference and inclusion in these proceedings, representing a rejection rate of 37%. To be eligible for inclusion these papers were required to receive a minimum score of 3 out of 5 allocated by the peer reviewers during the final review process.

Regards



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Conference Secretary

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REVIEW PANEL

The peer review process for an international conference of this nature requires the expertise and contribution of a number of international academics. We wish to thank the following people who carried out the review of abstracts and papers for DII 2014 conference in addition to the members of our Scientific Committee. Thank you for your contribution.

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Dear Author

PEER REVIEW PROCESS: INTERNATIONAL CONFERENCE ON INFRASTRUCTURE DEVELOPMENT AND INVESTMENT STRATEGIES FOR AFRICA – (DII 2014): LIVINGSTONE, ZAMBIA 2014

I confirm that the following peer review process was strictly undertaken in this conference. The need for high quality conference proceedings as evident in the accepted papers while complying with the requirements for subsidy of the South African Department of Higher Education and Training necessitates a rigorous two-stage peer review process by no less than two acknowledged experts in the subject area. In this context, submitted abstracts were twice blind reviewed. Authors, whose abstracts were accepted were provided with anonymous reviewers' comments and requested to submit their full papers noting and addressing these comments. Evidence was required relative to the action taken by authors regarding the comments received. The abstracts and resubmitted papers were twice blind reviewed in terms of:

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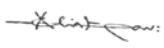

Dr Clinton O. Aigbavboa
Conference Secretary
Johannesburg, South Africa
25 September, 2014

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TO WHOM IT MAY CONCERN

It is herewith confirmed that the International Conference on Infrastructure development and Investment strategies for Africa – (DII 2014) is a fully peer-reviewed technical conference, where each published paper has undergone an extensive review process.

The process included a minimum of two or more reviewers from the international technical/scientific programme committee review panel.

Papers have been archived via electronic proceedings (USB Memory Stick)

An ISBN: 978-0-86970-782-1 has also been allocated.

For questions/queries, please do not hesitate to reach the conference organisers.

Dr Innocent Musonda

Chair: Conference Local Organising Committee

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The University of Johannesburg (UJ), is the largest, multi-campus, residential university in South Africa. It seeks to achieve the highest distinction in scholarship and research within the higher education context. Born from the merger between the former Rand Afrikaans University (RAU), the Technikon Witwatersrand (TWR) and the Soweto and the East Rand campuses of Vista University in 2005, the University of Johannesburg's unique academic architecture reflects a comprehensive range of learning programmes, leading to a variety of qualifications, from vocational and traditional academic to professional and postgraduate, across the four campuses –Auckland Park Kingsway, Auckland Park Bunting Road, Doornfontein and Soweto. The campuses vary in size and each has its own character and culture, contributing to the institution's rich diversity.

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

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

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

In its mission, UJ commits itself to the following:

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

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The values guiding UJ activities include:

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

In giving expression to its vision of being a pre-eminent South African and African

University UJ has set itself ten strategic goals. Its priorities are to:

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

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The Copperbelt University – History

With its motto "Knowledge and Service", the Copperbelt University (CBU) was established in 1987 as part of the University of Zambia. It was initially intended to be located in Ndola, about 50km South East of Kitwe, as Unzando (University of Zambia in Ndola). But since the University of Zambia (UNZA) had no infrastructure in Ndola at the time, Unzando was allowed to operate in Kitwe using the Zambia Institute of Technology (ZIT) infrastructure. ZIT was integrated into CBU in 1989, 2 years after the university was established. Until recently (when many public and private universities are now being established), the Copperbelt University was the only other university in the country after the University of Zambia. Currently the university has eight academic schools – School of the Built Environment (see details below), School of Engineering, School of Medicine, School of Graduate Studies, School of Business, School of Mines and Mineral Sciences, and School of Natural Resources. In addition, there is also the Directorate of Distance Education and Open Learning, and the Dag Hammarskjold Institute for Peace Studies. The total number of students in 2013 was about 9,300.

The School of Built Environment

The School of the Built Environment (SBE) (formerly School of Environmental Studies) was established in 1981 under ZIT when the School admitted its first students. The School remained temporarily situated at ZIT until 1989. The School of the Built Environment (SBE), therefore, increased its scope by taking on the ZIT Diploma courses in Architecture, Quantity Surveying, Land Surveying and Town & Country Planning, and Advanced Technician course in Construction. From 1990 etc. the University begun to offer these programmes at degree level. Currently, the School consists of four departments - Architecture, Construction Economics and Management (CEM), Real Estate Studies (RES, formerly Land Economy), and Urban & Regional Planning (URP). In addition, the school also offers a Master of Science programme in Project Management. The School also runs a Project and Consultancy Section called the Practice Office, which is responsible for undertaking consultancy services in various fields of the built environment. Currently, there are 5 undergraduate and 1 master's degree programmes offered in the school. These are BSc. in Quantity Surveying, and BSc. in Construction Management (both offered by the CEM Department); BSc. in Real Estate Studies (offered by the RES Department); BSc. in Urban & Regional Planning (offered by the URP Department); Bachelor of Architecture (B.Arch, offered by the Architecture Department); and the MSc. in Project Management (offered by the School of Graduate Studies). After successful completion of their degree programmes, our students join both public and private sector reputable organizations within and outside the country where they work as Architects, Design Consultants, Construction Managers, Valuers, Planners, Project Managers, Quantity Surveyors, Investment Bankers and many more. Other than the masters programme which takes up to 2 years to complete, all our

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undergraduate programmes are 5 years. Our students come from within and outside Zambia. In terms of staffing, it is the policy of the University that it recruits highly qualified personnel. For this reason, the university has put in place a policy where the minimum qualification of a lecturer is not only a masters degree but also that the masters degree must be in the same discipline as the lecturer's first degree. In addition to this profile, the SBE has a very ambitious programme where it intends to expand the school by introducing more programmes like the MSc. Degree in Land Management which will commence soon. This will help in meeting the ever increasing demand for qualified professionals within and outside the SADC region. For more information on CBU in general and SBE in particular, log on to www.cbu.edu.zm.

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UNIVERSITY OF ZAMBIA

THE SCHOOL OF ENGINEERING, UNIVERSITY OF ZAMBIA

Introduction

University of Zambia opened its doors in 1966, two years after independence Main Purpose was to produce Human Resources (Graduates) for Government and Industry in Zambia. From the first intake of students of 300 students, the population has reached to the current population of 21,700 The School of Engineering is one of the nine schools at the university and it is the located at the main campus of the University of Zambia in Lusaka. Over the years, the school has responded to various national challenges through teaching, research, training, consultancy and public service. The School of Engineering, now comprising the Departments of Agricultural Engineering, Civil & Environmental Engineering, Electrical and Electronic Engineering, Geomatic Engineering and Mechanical Engineering was established on 1st May 1969.

The school has a student population that is in excess of 450 undergraduate students and 90 postgraduate students across all the Departments. There are currently 40 academic members of staff distributed in the five departments in the School. The school is realigning itself to become a trainer of trainers by increasing its capacity in training at postgraduate level. The postgraduate programmes aim at training engineers with advanced and in depth knowledge in specialized fields.

The number of postgraduate programs have remained small a long period of time until the year 2010 when it became clear that there was a serious gap in trained man power in the energy sector. To address this gap the University of Zambia, School of engineering with funding from NUFFIC developed a Master's degree program in Renewable Energy which is hosted in the School of Engineering From this experience the School identified gaps in engineering management fields, the ICT sector, project management area and consequently developed a number of other programs in electronics, construction and engineering management related areas all with the aim of elevating the calibre of engineers in the country so that there is improvement in the management of engineering firms in line with the new technologies.

POSTGRADUATE PROGRAMMES IN THE SCHOOL

PhD Research Programmes

PhD research programmes offer a vast range of opportunities to students who relish the chance to undertake a research project with clear intellectual, scientific, industrial or commercial relevance and challenge. Currently these programmes are being offered in the

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Departments of Civil & Environmental Engineering and Mechanical Engineering. The School also undertakes interdisciplinary research in conjunction with other institutions.

The following is the list of programs at MSc level:

1. Master of Engineering research programme
2. Master of Engineering in agricultural engineering
3. Master of Engineering in environmental engineering
4. Master of Engineering in structural engineering
5. Master of Engineering in electrical power systems
6. Master Engineering in production engineering and management
7. Master of Engineering in thermofluids engineering
8. Master of Engineering in renewable energy engineering
9. Master of Engineering in project management
10. Master of Engineering i in construction management
11. Master of Engineering in engineering management
12. Master of Engineering in geo-informatics and geodesy
13. Master of Engineering in telecommunications systems
14. Master of Engineering in information and communication technology
15. Master of Engineering in information and communication technology security
16. Master of Engineering in information and communication technology policy and management
17. Master of Engineering in computer communications
18. Master of Engineering in wireless communications

With these new strides the university is answering the call from society of requiring a pool of well-trained engineers meeting the challenges of operating in the developing world while meeting the challenges of both the developing and the developed world.

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KEYNOTE ADDRESSES

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INFRASTRUCTURE DELIVERY

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CAPACITY DEVELOPMENT FOR LANDFILL INFRASTRUCTURE

Ogbeifun, E[1], Agwa-Ejon, J.[2] and Mbohwa, C.[3]

Abstract

Landfill, as a Municipal Solid Waste (MSW) disposal infrastructure, has progressed beyond mere dumping site to infrastructure of high economic importance; it is useful for entrepreneurial development, poverty alleviation scheme, energy generation and reduction in the emission of Green House Gas (GHG) and harvesting biogas for other economic use. The life cycle of a typical landfill structure is over thirty years from design to final closure; it has many components that include design, construction, operation, waste collection, transportation, recycling, maintenance and reuse of landfill site after closure. The whole process requires a steady stream of adequately resourced personnel. Therefore, embracing the concept of continuous capacity building will ensure the provision of suitable manpower at the strategic, tactical and operational levels for the effective and beneficial management of the landfill project throughout its life cycle.

This research is the product of extensive desktop search and examination of a training programme for personnel at the strategic and tactical level of a pilot landfill project, facilitated by the authors. The result showed that the trained personnel were empowered to train others at the various phase of the landfill project, thus ensuring continuous supply of competent manpower to operate the project profitably.

Keywords: Waste disposal, Landfill infrastructure, Dumping site, Operation, Capacity building

1.0 Introduction

Landfill, is the most common method of Municipal Solid Waste (MSW) disposal system the world over. It has progressed beyond mere dumping site to infrastructure of high economic importance; it is useful for entrepreneurial development, poverty alleviation scheme, energy generation, reduction in the emission of Green House Gas (GHG) and harvesting biogas for other economic use (Jaramillo and Matthews, 2005; Bosmans et al, 2013). Significant small and medium scale industries have been developed along the different phase of the MSW management system. The collection and transportation phases have witnessed lots of activities ranging from manual to mechanical processes. Sorting of MSW at source is an emerging trend in developing countries, however, informal sorting system through the activities of scavengers and buy-back is improving the amount waste being recycled, recovered for reuse and reducing the quantity of waste disposed of at the landfill sites (Memon, 2010**;** Usapein and Chavalparit, 2013). The quality and quantity of bio-gas produced from landfill infrastructure depends on the quality content of the solid waste and the methodology of depositing the waste at the landfill Site.

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The content of the bio-degradable waste will influence the quantity of the bio-gas produced. Depending on the size, a single landfill site can be reliable for the production of sufficient bio-gas for energy generation or bio-gas can be harvested from a combination of landfill sites. Further, the bio-gas can be harvested and fed into a grid system as alternative energy source for electricity generation (Jaramillo and Matthews, 2005). Thus the effective management of landfill structure provides economic advantage, clean and healthy environment for the benefiting community.

The life cycle of a typical landfill, depending on the size, span across many years from design, construction, operation, management and final closure. The activities of one phase have positive or negative effects on succeeding phases. Each phase requires best practice so that the entire landfill project will be economically viable and achieves the set objectives. It is imperative, therefore, that the personnel to manage the landfill project, from strategic, to tactical and operational levels should be adequately resourced in both technical and modern management system. Against the backdrop that the majority of the activities around the landfill project involve routine operations within health hazard environment, there is the possibility of high employee mobility. Therefore, continuous capacity building of the relevant cadre of employees is indispensable for the management and operation of functional and viable landfill project.

This research is the product of desktop search and examination of a training programme for personnel at the strategic and tactical level of a pilot landfill project facilitated by the authors. The result showed that the trained personnel were empowered to train others at the various phase of the landfill project, thus ensuring continuous supply of competent manpower to operate the project profitably.

2.0 Theoretical background

The management of MSW has attracted significant research activities in the past and in recent times due to the contribution of the gas emitted from landfill sites to the problem of global warming. The synthesis of literature, in this section, will be limited to key issues surrounding waste collection, separation, recycling, waste to energy and harvesting biogas for economic use as well as capacity building. These efforts are aimed at reinforcing the need for the development of adequately resourced persons for the effective operation of a functional landfill project.

2.1 Collection and separation of MSW

In the majority of communities, both developed and developing countries, the collection and disposal of MSW is the responsibility of the Local council or Municipal council; however, in limited cases, private entities are involved MSW collection and disposal. The most common scenario is where mixed waste are collected from door to door in residential, institutions or industrial areas and transported to the landfill site without sorting (Gallardo et al, 2012). Nevertheless, in order to realize the multiple benefits from landfill project, modern methodologies are required. This will facilitate the development of appropriate economic

[1,2,3] Department of Quality and Operation Management, Faculty of Engineering and Built Environment, University of Johannesburg, South Africa.

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activities around the collection and separation of waste so that limited quantity as well as quality waste is disposed in the landfill site that can facilitate the production of landfill biogas for other uses. Furthermore, efforts are being made, in developing economies, to embrace the culture of the 3R (Recycle, Reduce and Reuse) (Memon, 2010**;** Usapein and Chavalparit, 2013). In this regard, separation of waste is being given significant recognition. The separation can be in two levels, either separation at source, which requires extensive interactions with all stakeholders at both residential and corporate organizations or the sorting is done in designated collecting centre.

In developing countries, with high rate of unemployment, labour intensive method for the collection and separation of MSW, operation, including ancillary projects can be a viable avenue for creating meaningful employment and by extension poverty alleviation. To buttress this fact, Ofori-Boateng et al (2013) cited a landfill project in Ghana, that has energy generation component in MSW management system, engaging “510 persons per year” (Ofori-Boateng et al, p.100), in the construction and operation phase only. Researchers have examined the activities of scavengers and observed that if they are properly organized, they can play significant role in MSW collection, sorting and disposal (Agunwamba, 2003; Berkun et al, 2011; and Asim et al, 2012). It requires that this group of people be organized formally, so that the same or separate groups will be involve with the collection or and separation of the waste at the designated centres. The recyclable items are sold while the residue of waste is delivered to the landfill site. Alternatively, if it is not possible to organize the scavengers, the MSW should be transported to the landfill site where appreciable sorting is done by organized scavengers, who can sell their proceeds in the buy-back centre within the landfill site (Gallardo et al, 2012; Johari et al, 2012). In the developed economies MSW are being separated through semi-automated and automated processes (Baskakov, 2014). The non-recyclable waste are then used as feed stock for energy generation (Bosmans et al, 2013) or disposed off at the landfill site where biogas can be harvested in the future (Kumar and Sharma, 2014). It may appear as if managing the collection and separation of MSW before depositing in the landfill site is simple, yet the success of this phase depends on the level and competence of the coordinating personnel.

2.2 Municipal solid waste to energy

The search for alternative source of energy and the reduction in the emission of GHG has compelled many nations to develop economic use of the MSW deposited landfills. It is not necessary to re-invent the wheel in developing economies; instead they can adapt from a wide array of technologies to harness the resources available in landfill for economic advantages. There are two principal approaches for turning MSW to energy: either through the mechanical conversion of the pre-sorted MSW or harvesting the biogas that can be used for energy generation (Bosmans et al, 2013; Tsai and Kuo, 2010 and Ofori-Boateng et al, 2013). Though there are other by products that can be derived from landfill site, few of the possible alternatives should be tested first at the pilot level. The incineration method of converting MSW to energy is not too complicated and serves as a good starting point. It is worthy to note that “the successful implementation of Waste to Energy (WtE) technologies…depends on the WtE process efficiencies which are in their turn dependent on the feed quality” (Bosmans et al, 2013, p.12).

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The size of the incinerator varies depending of the available technology, the volume of regular waste and the use of the generated energy. Developing countries like South Africa, Turkey, Malaysia and Ghana (Couth et al, 2010; Berkun et al, 2011; Johari et al, 2012; Ofori-Boateng et al, 2013) have developed small to medium scale incineration plants for electricity generation to serve rural communities. National and global environmental law requires that an Environmental Impact Assessment (EIA) report must be produced before embarking on an incineration project (Abd Kadir et al, 2013). The MSW fed into the combustion chamber is subjected to high degree of temperature, the decomposed waste in gaseous state is transported to the gas turbine as heat to produce electricity or heat through the boiler for domestic (or industrial) use (Bove and Lunghi, 2006; Couth et al, 2010; Baskakov, 2014). The Internal Combustion Engine (ICE) is the most employed technology for electric energy generation from landfill gas (LFG) (Bove and Lunghi, 2006). The advantages of the ICE include reasonable initial capital investment, compact nature of the infrastructure so that it is easy to transport from one site to another, and the technology governing its operation are not too complicated. However, the major disadvantage of this system is the "high air pollution generated" (Bove and Lunghi, 2006, p. 1395), but this can be reduced by using "measures such as furnace design, air distribution and control engineering" (Bosmans et al, 2013, p.13).

Furthermore, adopting appropriate technology, the trapped bio-gas in an ongoing or closed landfill can be harvested for other economic use, such electricity generation, heating or fed into the national grid or delivered to other private concerns for industrial use.

2.3 Harvesting biogas for economic use

The quality of solid waste deposited in a landfill determines the rate of decomposition and the quantity as well as the quality of biogas produced (Niskanen et al, 2013). Depending on the size of the landfill, the recovered gas can be converted to energy for alternative use in the same landfill site or transported to another site; it can also be fed into the national grid (Jaramillo and Matthews, 2005). If there are no immediate plans designed for the use of the biogas, it can be sold to other interest group(s) for further use. Besides harvesting the bio-gas for alternative energy usage, it reduces the risk associated to the emission of GHG and other environmental pollution that are harmful to human health and vegetation (Niskanen et al, 2013 and Kumar and Sharma, 2014). The technology for harvesting the biogas can be incorporated into the construction of a new landfill or constructed into closed landfill. The setting involves a network of perforated pipes that are installed in a vertical, inclined or horizontal position and connected to gas extraction engine (Couth et al, 2010; Bidart et al, 2013; Kumar and Sharma, 2014). Depending on the size of the landfill, the generation of LFG "starts shortly after a landfill begins receiving waste and can last for up to 30 years after the landfill closes" (Jaramillo and Matthews, 2005, p.7365).

The most suitable extraction engine should be chosen based on the capacity, energy efficiency of the engine type and ready market of experts to operate and maintain the engine. Couth et al, (2010) suggests the use of gas engine because it "offer a greater range in their output from around 50% to full load (e.g. 0.5 – 1MW)" (Couth et al, 2010, p.401). Other engine types are equally suitable depending on the environmental conditions in the site of installation and the level of technical competence of the operators. Common problems associated with these extraction engines include blockage of the suction track (de-coking)

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caused by the solid waste particles extracted along with the gas and oil circulation within the engine (Couth et al, 2010). The extracted gas is stored and screed off of all waste particles and then fed into reciprocating Internal Combustion (IC) engines. “IC engines burn landfill gas in the presence of oxygen to turn the engine; this engine is connected to a crankshaft that turns a generator and produces electricity” (Jaramillo and Matthews, 2005, p. 7366). South Africa, as well as some other developing countries, has experimented with the extraction of bio-gas from landfills to generate electricity for small rural communities. From 2011 till date, 38 gas production and energy operation sites have been registered, in South Africa, for generation of electricity for rural communities (www.thenewage.co.za).

Due to lack of appropriate technical experts, poor maintenance, the equipment installed in many landfill site are either performing bellow installed capacity or have stopped functioning (Couth et al, 2010; Johari et al, 2012; Ofori-Boateng et al, 2013; Bosmans et al, 2013); thus highlighting the need for the development of appropriate human capacity to serve as the lubricant that oils the wheel of landfill project to be able to deliver economic value as well as provide positive environmental impact on the community proximate to the project.

2.4 Capacity building

The term capacity building can be applied to different aspect of the same concept; it suggests the increase in the ability, capability and resource of people as well as institutions to be able to execute a given task. Capacity building can be described as: “…the development of institutional, organizational, managerial, and technological (both soft and hard), and individual abilities, capabilities, skills, and knowledge….” (Farazmand, 2004, p.5). Capacity building can also be seen in the light of: “…individual training, construction of physical facilities, and infrastructure and organizational development (Horton, 2002, p. 3). The developments could be in technical, managerial, financial, legal, etc. capacity; indeed all areas considered necessary for the effective execution and operation of the desired project. Effective capacity building requires selecting the right calibre of persons in the vertical and horizontal (Farazmand, 204) component of the relevant organs that will execute the infrastructure project. In every infrastructure delivery and in particular the landfill project, the technical personnel are the engineers and related professionals while the horizontal components include but not limited to the Human Resource (HR) division, health personnel, logistics, legal, community relation officers and finance department. Successful capacity building exercise should not be seen as a one-off activity, because such attempts hardly produce lasting change in the participants’ behaviour (Horton, 2002). In order to inculcate the culture of continuous capacity building into infrastructure development projects, Potter and Brough (2004) suggests what they refer to as ‘system capacity’ development. Explaining further, they opined that “An organizational *system* is composed of a network of *programmes* of services, *staff, facilities, structures* ... and *process* of supervision, decision-making, information passing, financial flow, and so forth” (Potter and Brough, 2004, p. 339). The words in italics are the component parts of an organization that requires specific capacity developments on continuous basis. The authors developed a framework for capacity development that include nine critical areas thus: Programme capacity, personal capacity, workload capacity, supervisory capacity, facility capacity, support service capacity, systems capacity and role capacity; suggesting that each of these capacity functions be developed based on the hierarchy of needs (Potter and Brough, 2004).

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Though considerable efforts have been devoted to specialized capacity building to manage infrastructure projects in Africa, however, the concept of systemic capacity building has not been given serious consideration. Thus the investments in the development of human capacity, physical facilities, and equipment are not yielding the desired results, until there is a functional system in place. The lack of such system is evident in the “Poor supervision, lack of accountability …slow disbursement of budget, lack of authority, corruption, and lack of attention to support systems, such as maintenance, information systems, destroyed confidence and initiative ((Potter and Brough, 2004), p.339). Another setback is the frequent movement of trained personnel from one office to another, in some cases, outside the area where their capacity was recently developed. In this regard, less resourced persons are saddled with the responsibility of managing the infrastructure project which is beyond their level of competence.

Landfill infrastructure has assumed a strategic component in the effective management of MSW, besides being a mere dumping site, it is an instrument of social transformation, environmental management, mitigation of negative factors of global warming, and active agent in poverty alleviation. In order to achieve these and more benefit from landfill project, it is imperative that the project be managed throughout its life cycle by adequately resourced personnel, by embracing the concept of continuous (systemic) capacity building.

3.0 Research method

Extensive literature search helped to locate the dynamics in the management of landfill project as MSW disposal system, exposing the many dimensions of its positive contribution to local and national economy, enhancing healthy environment and contribution to the mitigation of the emition of GHG. The search brought to fore the multi-dimensional components of landfill project thus justifying the need for adequate human resource to manage the project. Further, the research examines the training programme for vertical and horizontal personnel of an African country embarking of the use of landfill as MSW disposal system. The training involved personnel at the strategic and tactical level of a pilot landfill project. The result showed that the trained personnel were empowered to train others at the various phase of the landfill project, thus ensuring continuous supply of competent manpower to operate the project profitably.

4.0 Findings and discussion

This section briefly report on the training session facilitated by the authors, for the pioneer personnel for the pilot landfill project about to be embarked upon by an African country.

4.1 Course objectives

The course objective was to provide comprehensive information on the planning and efficient operation of landfill as suitable MSW disposal system. This include discussion on site selection, legal, environmental, community, design and construction considerations with the aim of developing an infrastructure that is environmentally friendly and reduce the risk of pollution and contamination of the source of water supply to the community. Furthermore, the course was to explore the modern economic use of landfill and expose the participants to the practical administration of landfill projects by some municipalities in South Africa.

4.2 Course participants

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The course participants were drawn from the core engineering profession (the vertical component) and the indirectly related but relevant professionals (horizontal component) within the same municipal councils were the pilot projects were to be sighted. The participants were officers in the strategic and tactical level of leadership. Though some of the participants were advanced in age and years of service (who may not be in active service when the landfill project will become fully operational), the majority of the personnel from the vertical and horizontal component were young and have longer years of service. The beauty of this arrangement is the strength derivable from the mix where the voice of the older ones will guide the project proposal, providing the needed *force* to make the project attractive to their home government and the younger ones will provide the strength, innovation and enthusiasm to run with the project, allowing continuity of credible leadership for a long time (Potter and Brough, 2004). Furthermore, the composition of the participants from the vertical and horizontal component of the municipal structure facilitates easy comprehension of the concept of the landfill project, its complex details, and involvements. Though all of them may not grasp the technical details, their participation in the training prepares them for objective interactions with the professionals when discussing the implementation plans and can fast track approvals (Potter and Brough, 2004; Couth et al, 2010; Johari et al, 2012; Ofori-Boateng et al, 2013; Bosmans et al, 2013). The contribution of the participants from the horizontal component were sincere and thought provoking, challenging the professionals to provide suitable answers; they represented the voice of the community who will be at the receiving end of the landfill project (Memon, 2010**;** Usapein and Chavalparit, 2013, Ofori-Boateng et al, 2013). Though the management of the MSW provides a potential solution to the issue of unemployment in developing economies, the health personnel in the team were passionate on the safety of the scavengers, other direct and indirect employees in the chain of services and the proximate communities (Agunwamba, 2003; Berkun et al, 2011; and Asim et al, 2012; Gallardo et al, 2012). The mixture of participants, the quality of deliberation and the content of the assignment submitted at the end of the course, provides hope that the participants will execute meaningful landfill projects.

4.3 Course structure

The course structure provided a blend of theoretical foundations of landfill project from concept, site selection, environmental, legal and community considerations. It provided detailed geotechnical and geological consideration, especially as it affects pollution of the source of water for the proximate community (Rowe and Fraser, n.d.). Strong emphasis was laid on the construction phase of the landfill project. Realising that the entire landfill site cannot be constructed in a seamless process, close attention should be paid to the water proofing system and leachate management to reduce the risk of ground water pollution (Fellner et al, 2009; Voronova et al, 2011). The loading of waste material into the landfill should be handle carefully so that the water proofing membrane layers are not destroyed, the leachate collection system are not clogged and the bio-gas harvesting pipe network are not distorted, nor are the monitoring devices dislocated.

Participants were exposed to the economic benefits of landfill project, especially the generation of electricity. Nevertheless, as a pilot project, participants were encourage to experiment with waste to energy through harvesting bio-gas from different landfills and generate electricity from a central point (Jaramillo and Matthews, 2005; Niskanen et al, 2013; Kumar and Sharma, 2014). If any infrastructure, landfill inclusive, is to serve its

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purpose, the operators should imbibe the culture of maintenance management; thus encouraging the concept of continuous capacity building for the down-the-line operators of the landfill project. It is rewarding to note that the formal closure of the operation phase of an active landfill is not the end of the project. The harvesting of the bio-gas continues for a long time. At the end of LFG harvesting, the landfill site can be transformed into other profitable use, such as sports and recreation field, stadium development, shopping complex, low-rise residential houses, and so on (Dalal et al, 2010).

4.4 Course outcome

The participants were divided into six groups (ensuring a proper mix of the vertical and horizontal composition) and given assignments encapsulating the entire course (lecture and field trips), with each group concentrating in an aspect of the landfill project. The objective was that when the whole assignment is compiled into a single volume, each group will have access to complete information to guide them for the effective implementation of a landfill project. The assignment covered policy formulation for the development of landfill project; site selection, design and construction considerations; practical issues in the operation of landfill: biogas harvesting and leachate management; logistics and cost development; capacity building and maintenance management as well as management system, monitoring and evaluation.

5.0 The Japanese experiments

Japan, like many other developed countries, is turning their challenges into opportunities for developments. The shortage of suitable landfill site for the disposal of MSW has driven Japan to embrace the concept of 3Rs and they have recycled anything within their environment, through effective separation of MSW. For example, the segregation pattern employed by Kamikatsu town, which is in a rural community in Tokushima area, includes the separation of:

> Aluminium cans, steel cans, spray cans, metal caps, bin without colour, brown bin, other bin, reuse bin, other glass and ceramics, cell battery, fluorescent lamp, broken fluorescent lamp, mirror and thermometer, electric bulb, expanded polystyrene, used clothes and textiles, tetra pack, cardboard, newspaper, magazine and copy paper, chop stick, PET bottle, cap of PET bottle, lighter, futon and carpet, diaper and sanitary napkin, waste food oil, plastic package and container, combustibles which has no other use, waste battery and tire, bulky garbage, home appliances, organic waste, and PVC for agriculture and bottle for pesticide (Kojima, 2013).

The success being recorded hinges on the fact that the country encourages separation of waste at source. Further, this concept is strengthened by the establishment of cortege industries that concentrate of washing the dirt, from primary use, off plastics articles making it ready material for use by recycling industries. These cleaned plastic products can packaged as they are or reduced into pellets, delivered to local industries or exported to boost oversea trades (Robison, 2013). Another local use the Japanese have done with MSW is the “Plastic – to – oil – Technology”; were they have developed heavy duty fuel suitable for the operation of generators, boilers and construction equipment (Robison, 2013). This option requires a great deal of technology, investment and certification process that it may not be a viable project for developing economies in the elementary stage of integrated MSW management. Nevertheless, the plastic cleaning plant is worth investigating; it will provide reasonable source of income to many people, encourage separation of waste at source, improves environmental hygiene, cleaner gutter and reduction in the menace of flooding due to blocked drainage system from plastic waste.

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6.0 Conclusion and recommendation

The use of landfill as a means of MSW disposal system is a proven and acceptable methodology all over the world. Nevertheless, the system has progressed beyond mere dumping site to infrastructure of economic and environmental concern, requiring highly resourced personnel to manage the venture. The search for alternative source of energy and the reduction in the emission of GHG has compelled many nations to develop economic use of the MSW deposited landfills. It is not necessary to re-invent the wheel in developing economies; instead they can adapt from a wide array of technologies to harness the resources available in landfill for economic advantages. In a pilot project, it may be reasonable to start the 'waste to energy' system from harvesting bio-gas trapped in an ongoing or closed landfill for other economic use, such electricity generation, heating or fed into the national grid or delivered to other private concerns for industrial use.

Effective capacity building requires selecting the right calibre of persons in the vertical and horizontal (Farazmand, 204) component of the relevant organs that will execute the infrastructure project. In every infrastructure delivery and in particular the landfill project, the technical personnel are the engineers and related professionals while the horizontal components include but not limited to the Human Resource (HR) division, health personnel, logistics, legal, community relation officers and finance department. Successful capacity building exercise should not be seen as a one-off activity, because such attempts hardly produce lasting change in the participants' behaviour (Horton, 2002). Though considerable efforts have been devoted to specialized capacity building to manage infrastructure projects in Africa, however, the concept of systemic capacity building has not been given serious consideration. Thus the investments in the development of human capacity, physical facilities, and equipment are not yielding the desired results, until there is a functional system in place.

The selection of participants for the training by the host country was well thought of, they were drawn from the core engineering profession (the vertical component) and the indirectly related but relevant professionals (horizontal component) within the same municipal councils were the pilot projects were to be sighted. The participants were officers in the strategic and tactical level of leadership. Furthermore, the composition of the participants from the vertical and horizontal component of the municipal structure facilitates easy comprehension of the concept of the landfill project, its complex details, and involvements. Though all of them may not grasp the technical details, their participation in the training prepares them for objective interactions with the professionals when discussing the implementation plans and can fast track approvals (Potter and Brough, 2004; Couth et al, 2010; Johari et al, 2012; Ofori-Boateng et al, 2013; Bosmans et al, 2013). The mixture of participants, the quality of deliberation and the content of the assignment submitted at the end of the course, provides hope that the participants will execute meaningful landfill projects.

Furthermore, research endeavours should be channelled towards exploring how to identify the relevant components of the 'system' around any proposed or infrastructure in operation that requires enhanced capacity (Potter and Brough, 2004).

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OPPORTUNITIES FOR BETTER DELIVERY OF INFRASTRUCTURE BY THE ZAMBIAN CONSTRUCTION INDUSTRY

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Abstract

The traditional procurement method (TPM) that is most commonly used in developing countries including Zambia has advantages and deficiencies that have to be contended with by the different players in the construction industry. Thus, a research 'CONSTRUCTION PROCUREMENT AND PROJECT PERFORMANCE: A Case for the Use of Alternative Construction Procurement Methods in the Zambian Construction Industry', was embarked on. Although the most common **project performance** criteria used for measurement of success focuses on time, cost and quality, the research identified and used additional criteria of occupational safety, health and environment; innovation and skills transfer, to assess the satisfaction of the players in the Zambian Construction Industry (ZCI) with the TPM. The dissatisfaction with the TPM has led to the emergence of **alternative construction procurement methods (APMs)** to counter the short-comings of the TPM. The main aim of the research was to establish if the use of APMs can improve project performance in the ZCI.

A representative sample of the ZCI, which included, consultants and contractors was purposively selected for a questionnaire survey. The data collected was both qualitative and quantitative. The data was analysed qualitatively while the hypothesis was tested quantitatively. The major findings from the research indicate that although the Zambian Construction Industry (ZCI) is most familiar with the TPM, the method is unable to consistently deliver on the project success criteria. The research also revealed that the attributes of the APMs are sufficient to satisfy the needs of clients in the ZCI, despite some barriers. A major recommendation from the study is that information on the APMs should be made available to the players in the ZCI to encourage utilization.

Keywords: Traditional Procurement Method, project performance, alternative procurement methods, Zambian Construction Industry

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1.0 Introduction

The rate, cost and quality of delivery of infrastructure projects in Zambia has been hampered by a number of factors including, capacity of the players (consultants, contractors), procurement processes and funding for projects. Although alternative procurement methods (APMs) exist, they are relatively new and the traditional procurement method, with its deficiencies continues to be used. A research was therefore embarked on to address the concerns by industry on the TPM. This research was part of the requirements for the International Master of Science Degree in International Construction Management at University of Bath. This paper reviews the TPM and the various APMs and makes recommendations to enhance uptake of APMs by the Zambian Construction Industry.

2.0 Construction Procurement Systems

There are various procurement systems used to fulfil a clients' needs. A procurement system has been defined by Davies et al (2008) as a system that assigns specific responsibilities and authorities to people and/or organisations and also defines the various elements in a construction project. Procurement systems govern the delivery processes of a construction project in many ways and are key in determining the success or failure of any particular project. The various different types of procurement systems include the TPM, the design and build method, management methods which include management contracting and construction management and partnering.

Most construction industries in developing countries have been using the TPM for most public and private construction projects; this method was inherited from the western countries which have a different history, culture, collective experience and breadth of construction expertise (Ofori G, 2010).

In any project, the criteria of quality, time, cost and risk are paramount and they aid the client in the process of determining the procurement process that is to be used for a particular project. The aspects of cost, time, quality and utility, this time, are sometimes called the client's objectives (Rwelamila et al, 1999). Rwelamila et al (1999) also mention that in a construction project the cost often refers to the first cost; time is the timing of the project (completion period); quality as the level of specifications required and finally utility as running costs, maintenance costs, buildability and flexibility for alterations or other uses.

3.0 The Traditional Procurement Method

According to Mohsini et al (1995), traditionally, the success of construction projects was due to the fact that all participants in the building process knew what was generally expected of them. The TPM has a clear distinction between the processes of design and construction. In this procurement system, all parties except the domestic sub-contractors have direct contractual links with the client. The parties to the process are the Client, the Consultants and the Contractor.

The industrial revolution brought in the separation of design from construction as it became necessary because of the complexity of the new building projects. The method of design-bid-build then became common and became known as the TPM. The TPM became the first procurement system that was commonly used and it had emphasis on competition to get the best bid which was in most cases the lowest bid.

Traditionally after the industrial revolution; different players could not be available for extensive multi-tasking and also the industry did not have the capacity of handling complex projects. In this approach, the client recognises that consultants are appointed for design, cost control and contract administration whereas the contractor is responsible for carrying out the works (www.thenbs.com).

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According to the JCT Ltd (www.jctltd.co.uk), other features of the TPM are;

1. Main contractor is usually selected by competitive tender
2. Client appoints independent contract administrator to oversee the project execution
3. There is price certainty as cost of construction is known at the beginning of works but the contracts usually have a provision for cost adjustment if required in the contract
4. Risks are balanced between the client and the contractor.

4.0 Concerns of Traditional Procurement Method

Noor (2012) has pointed out that some of the concerns raised on the TPM are that it has been reported to be cumbersome, time consuming, many times resulting in delays in project execution and adversarial relationships often leading to legal disputes. Davies et al (2008) have also stated one concern that the contractor gives no input in the design as they are appointed after the design has been completed; this may lead to buildability problems in complex projects. Ofori G (2010) notes that although the construction industry everywhere has problems and challenges, the problems and challenges in developing countries exist alongside general socio-economic stress, chronic resource shortages, institutional weaknesses and general inability to deal with the key issues.

5.0 Project Performance under the Traditional Procurement Method

According to Dissanayaka et al (1999, 35) a project is considered to have been an 'overall success if the project meets the technical performance specifications and/or fulfils the specified mission to be performed and if there is a high level of satisfaction concerning the project outcome among principal participants in the project team and the key users'. As construction contributes to about 7-10% of GNP for many countries' economies, the efficiency of the industry is very important (Eriksson P.E and Westerberg M. 2009). Eriksson and Laan (2007) cited in Eriksson and Westerberg (2009) states that traditionally relationships in the industry/project are very competitive and adversarial due to the procurement system, causing many problems in all stages of the construction process. According to Eriksson and Westerberg (2009), traditionally researchers have focussed on the three main project performance criteria of cost, time and scope (quality and quantity) but now more criteria has been included and these are occupational health, safety, and environment; innovation and skills transfer.

6.0 Alternative Procurement Methods

Simister (2009) note that a shift has emerged which does not place too much reliance on open competition and also that the best value for money does not necessarily come through the lowest bid. Therefore, modern procurement systems place less emphasis on cost and greater emphasis on achieving value for money. The alternative methods are distinguished by their interaction between design and construction, as follows:

6.1 Design and Build/Package Methods

A design and build (D&B) contract is where the client avails a contract sum to design and build a construction project; the sum is inclusive of both the cost of design and construction.

Some of the advantages of the D&B procurement method are as follows;

1. Speed of delivery from concept to completed building as it allows work to start on site earlier even before the completion of the design. The method also ensures early contractor involvement to enhance the constructability of the project plans

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(www.fhwa.dot.gov). The bid phase for a construction contractor is eliminated thereby reducing the time from inception to completion.

2. Single point responsibility for both the design and construction of the project.

3. Cost certainty is assured provided the client's requirements are accurately specified (www.bib.irb.hr/datoteka). The reduced potential for claims and litigation after project completion also leads to better cost certainty as all issues are dealt with in the D&B team before and during the construction project. The contractor is able to provide their buildability experience in the design (provides value for money for the client and also profit for the D&B team).

4. Improved quality of the construction project due to greater focus on quality control and quality assurance by the involvement of the design team throughout the project (www.fhwa.dot.gov). The contractor may also provide new and innovative construction methods and procedures in the particular project.

5. Lower costs are encountered as all consultants' costs are with the D&B organisation and therefore the client does not need to spend money on the engagement of separate design and engineering firms (Davies P et al, 2006).

Some of the disadvantages of D&B method are as follows:

1. The client has less control and influence over design matters as the contract is given out based on the brief and proposal by D&B firm (www.rics.org/consult.it)

2. It reduces competition for services as it excludes smaller firms who cannot amass the required professionals to be in the D&B team; it favours big firms.

3. As the contractor takes on a fair amount of risk, the initial price may be higher as the contractor will put in an element of risk (ibid).

4. It increases project costs in the sense that it eliminates the low bid contractor selection criteria.

6.2 Management Contracting (MC)

In this method, the client engages a contractor usually in the early design phase to manage the project (Simister, 2009). The Management Contractor manages the different packages of construction work executed by specialist contractors by ensuring that the processes are well co-ordinated.

The main advantages of MC procurement method are:

1. It allows for the input of the contractor early in the design phase on buildability of the project (www.rics.org/consult.ti)

2. There is a single point contract and payment system for the management contractor and works contractors

3. It is good for fast track complex projects where there is minimal design information at the start of the project (www.rics.org)

4. There is certainty of cost in that the management fee can be fixed

5. The client retains great control over all aspects of the project including quality and client has more room to make changes

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6. The client has the leeway of flexibility in design making and makes the final decisions

7. There is competitive bidding amongst management contractors hence the client gets value for money.

The main disadvantages of the management contracting method are as follows:

1. The client may become overwhelmed with the large amount of minute details of the project as they still have direct relationships with the management contractor and the consultants

2. The financial relationships are quite many and the finance department of the management contractor have to deal with many different companies

3. There may be substantial cost increases after the initial cost.

6.3 Construction Management (CM)

Under this method, the Construction Manager is engaged to carry out work through trade contractors (www.rics.org). The Construction Manager is engaged by the client as a consultant at a fee for the works done (Simister 2009), and is often times a contractor with project management skills. This kind of procurement method requires that the client has constant involvement and is therefore very well suited for experienced clients who are able to have that level of involvement and also give the correct required brief for the works to be done (www.constructingexcellence.org.uk 2004).

Some of the advantages of the method are as follows:

1. Client has more control of the construction process through the engagement of the Construction Manager while still having separate contracts with the works contractors
2. The client has better control over the budget and overall project cost as the works are broken down into smaller trade packages
3. The design and construction process are fully integrated (www.rics.org/consult.ti) and therefore less potential for claims
4. The client's requirements are easy to accommodate as the process is flexible in the client's favour
5. There is a shortened lead time between design and construction as the two processes are integrated
6. Increased quality control because innovative and practical alternatives can be incorporated into the project more easily. The construction manager also assists in ensuring proper quality control (www.structuretec.com).

Some of the disadvantages, on the other hand, are as follows:

1. To be cost effective, only large or complex projects can benefit from the method
2. The client is responsible for the design through the design team he engages
3. The client shoulders the trade contractors risk in case of non-performance
4. This method is best suited to experienced clients with good internal management skills

6.4 Partnering

Partnering is a concept that can be applied to many different procurement routes and cannot in essence be called a separate method on its own (www.rics.org/consult).

This method can be classified into two primary categories:

a. Build, Operate and Transfer (BOT), and

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b. Build, Own, Operate and Transfer (BOOT); this method includes a variant called the Private Finance Initiative (PFI) (Simister, 2009).

In the BOT and BOOT methods, the client is handed over the complete project ensuring that the client is relieved from many issues inherent in the procurement process like financing (Simister, 2009). Financing is handled by the concession and the client may also earn some income during the period of beneficial use by the operator/promoter (Simister, 2009). In the PFI variant, the private sector receives output specifications from the relevant public body/sector and designs, builds, finances and operates the facility in exchange for either user fees, lease payments or any other revenue stream identified.

Advantages of the partnering systems identified are as follows:

1. A reduction in the number of disputes (www.rics.org/consult)
2. Early supply chain involvement (Ibid)
3. Integration of design and construction processes
4. Provides alternative revenue and funding sources to close funding gap
5. Allows use of low cost tax-exempt or taxable financing
6. Transfers risk to the private sector hence very favourable for the public sector
7. Takes advantage of private sector efficiencies and innovations in construction scheduling and financing
8. Provides efficiencies in long-term operations and maintenance of public facilities
9. Good for economic development as can combine use of public and private mixed-use developments to leverage economic development.

Some of the disadvantages of the partnering system have been identified as follows:

1. The client/public sector may experience higher total life cycle costs
2. A high level of expertise from all players is required to execute a partnering project
3. The partnering approach may be abused by one of the parties
4. As the process may not be very competitive the client may end up paying more for the service.

7.0 Research - CONSTRUCTION PROCUREMENT AND PROJECT PERFORMANCE: A Case for the Use of Alternative Construction Procurement Methods in the Zambian Construction Industry

7.1 Study population and Sample Size

The study population included the registered firms in Zambia offering engineering, architectural and quantity surveying services; 41, 43 and 31 firms, respectively. The second category included contractors in Zambia that have capacity to undertake large construction works, in Grades 1 to 3; 124 according to the 2013 NCC Register. Clients comprised the third category. The researcher used the expert and purposive sampling methods to get a representative sample. Table 3.1 shows the population and sample size.

Table 3.1 Research Sample Size

Study Population	**Sample Size**	**Percentage Of Study Population**
Architects – 43 Quantity Surveyors - 31 Engineers – 41, Total consultant firms – 115	Sample size for all consultants - 40	35%
Clients – assumed 50	15	30%
Contractors – 124	45	36%

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7.2 Research Results and Data Analysis

Out of 100 questionnaires distributed the response rate was 71percent. As this rate is more than the 30% response rate needed in order to ensure that the sample is still representative according to Fellows et al (2008), the researcher proceeded to analyse the data.

(a) Procurement Methods used before by Consultants

Figure 3.1 gives the response on the procurement methods used by the ZCI.

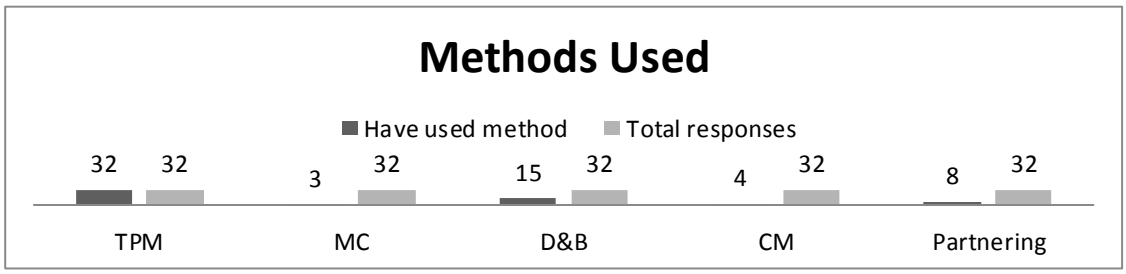

Figure 3.1 Procurement methods used. Source: research 2013

Figure 3.1 indicates that all the respondents stated that they have used the TPM before; 9% have used the MC method; 46% have used the D&B; 13% have used CM and 25% have used the partnering method.

It can therefore be seen that the TPM is the most common method used by the consultants and this is mostly because almost all players in the industry are familiar with. The APMs did not fare as well with only 25% of the respondents stating that they had use the D&B before. The least used method is the MC.

(b) Procurement Methods used before by Contractors

Figure 3.2 shows how the methods fared with the different contractors. This is in keeping with the trend found in the consultants in that all have been exposed to the TPM while the rest of the methods have very little exposure among the contractors. As these contractors are in the first three grades in the NCC grading system (Grade 1- unlimited tender restrictions; Grade 2 - Contract works of up to $30million; while Grade 3 Contract Works of up to $10million), and as the new construction procurement methods are mostly introduced by clients who have used them before e.g. foreign clients

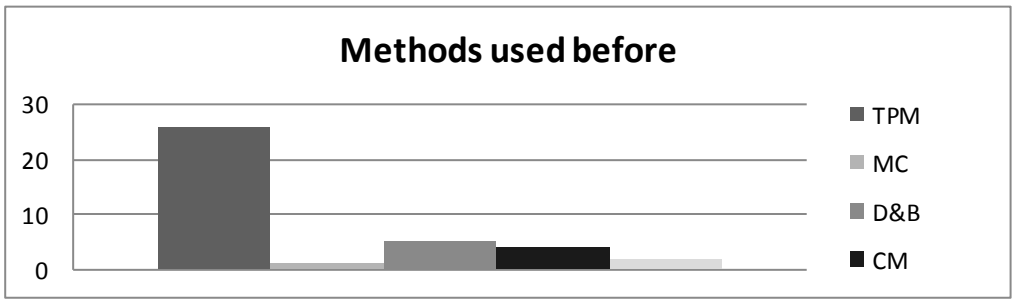

Figure 3.2 Procurement methods used before. Source: research 2013

All the contractors had used the TPM and only five had used the D&B method whilst the numbers for CM, partnering and MC were quite low with five, two and one, respectively. Overall, the majority of the contractors have not used the alternative procurement systems before.

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(c) Procurement Methods used before by Clients

All clients indicated that they were more familiar with the TPM as they had used it before. D&B method came in second, followed by partnering. MC came out last as none of the clients stated that they had used it before.

The TPM was the one they were most familiar with as it is the most common procurement method used in the ZCI. This is in line with the findings for the consultants and the contractors as well.

(d) Views on Traditional Procurement Method

Table 3.1 gives views on the TPM whilst Figure 3.3 summarises the response on satisfaction with TPM. The general statement on satisfaction of the respondents is summarised in Figure 3.3.

Table 3.1: Views on the TPM

		Strongly agree (4)	Agree (3)	Disagree (2)	Strongly disagree (1)
a.	The distinction between design and construction is clear	48	19	3	0
b.	The time taken for the design process is usually sufficient for a good design	8	27	34	0
c.	The time between the design process and the construction process is short	5	21	43	2
d.	The project is delivered on time	0	12	41	16
e.	The project is delivered to cost as per budget	0	17	45	7
f.	Quality of completed construction is as per the specifications	7	45	17	0
g.	Delivers good value for money	5	25	35	0
h.	There is skills transfer during the construction period	3	25	37	4
i.	Offers innovation in the methods of construction	2	18	45	7
j.	Offers innovation in the way construction funds are managed	5	10	27	17
k.	Workers are deemed as most important resource on site	1	15	29	25
l.	There is generally poor project performance using the TPM	17	39	13	2

Source: research 2013

(e) Rating of Traditional Procurement Method

Table 3.2: Rating of the TPM

	Very high (4)	High (3)	Low (2)	Very low(1)
a. Delivers projects on time as per the initial set time frame	14	25	29	2
b. Delivers projects to cost as per the initial budget	12	20	36	1
c. Quality of the completed construction is as per the specifications given	17	34	20	0
d. The completed construction has good fit for purpose	14	16	40	0
e. Completed project is as per the client's initial briefing	15	17	38	0
f. Other (specify)……Building maintenance				1

Source: Research 2013

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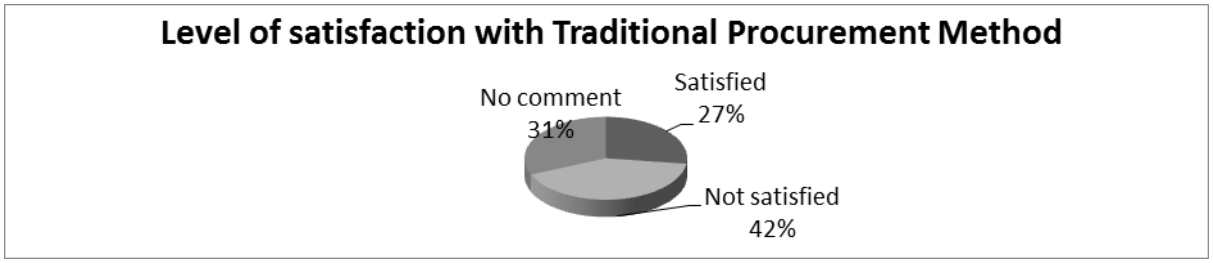

Figure 3.3: Level of satisfaction with TPM. Source: research 2013

The research indicated that the TPM does not deliver the project on time and to cost but that the quality is usually as per the specifications. This finding agrees with the comments on whether the completed project has good fit for purpose and completed project being as per the client's initial briefing in that because of the cost and time, the end result may not be as per the initial planned.

(f) Project Performance

Table 3.3: Project Performance

	Very high (4)	High (3)	Low (2)	Very low (1)
a. Timeframe of the project is known at onset	33	32	6	
b. Early contractor involvement	6	9	26	30
c. Contractor experience in constructability	13	29	26	2
d. Good relations among project parties	25	33	12	1
e. Input of all stakeholders in design process	6	23	29	13
f. Speed of delivery of project from concept to completion	3	24	34	10
g. Single point responsibility for both design and construction	7	32	18	14
h. Cost certainty of project	20	32	17	2
f. Improved quality due to greater focus on quality control	22	35	14	0
i. Contractor input early in design phase	16	20	8	27
j. Client control over design	21	36	14	0
k. Client control over budget	19	33	12	3
l. Short lead time between design and construction	18	32	15	6
m. Innovations in construction methods	13	35	18	5
n. Innovations in construction finances	6	16	36	13
o. Early supply chain involvement	15	28	20	8
p. Innovations in construction scheduling	12	33	22	4

Source: Research 2013

(g) Project Success Criteria

Figure 3.4 shows the respondents experience in the last five years in terms of the project success criteria. Only statistics for the project criteria which were 100% met were used in the analysis.

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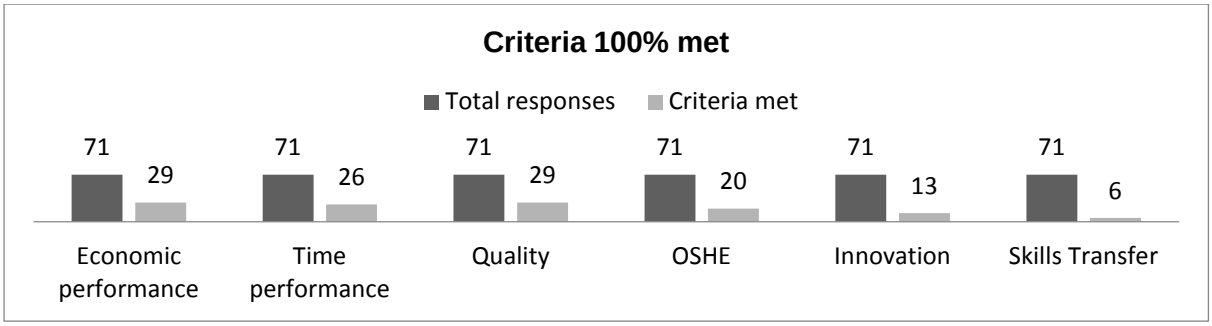

Figure 3.4: Project performance in last five years. Source: research 2013

Only 40% of the respondents stated that the economic performance of the project was met for at least one of their projects in the last five years; a rather low number as cost control of the project is very important.

37% of the respondents reported having had time fulfilled in at least one of their projects in the past five years; here also the figure is low; time is of the essence for project performance.

40% reported having had the criteria of quality met in at least one of the projects in the past five years; the figure here is also low as a large number of respondents viewed quality as very important for project performance.

28% of the respondents reported success in the Occupational Health and Safety and Environment during the last five years in project performance. The figure is quite low especially that human resources are key for project performance.

Only 18% of the respondents reported satisfaction that innovative actions were taken during at least one project in the past five years. This figure is quite low and is mostly attributable to the TPM currently almost exclusively being used by the respondents and this method does not allow for innovation.

Skills transfer only scored s 8% as this is mostly because there is no deliberate system in place to ensure that there is skills transfer during the life of the project.

(h) Alternative Procurement Methods Used

The research showed that 32% of the respondents had not used any of the alternative procurement methods before. 24% stated that they have used the D&B method, 15% indicated that they had used the partnering method; 13% had used the CM method and only 6% have used the MC method.

The extensive use of the TPM has led to poor uptake of the new methods on a larger scale. Lack of knowledge of the new systems has also contributed.

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(j) Advantages and Barriers Encountered in the use of APMs

Table 3.4: *Advantages and Barriers to use of Alternative Procurement Methods*

DESIGN AND BUILD	
Advantages encountered	**Barriers encountered**
1. Integration of design and construction allowed for speedy procurement ensuring time efficiency 2. The contractor was responsible for everything – single point responsibility including all communications and payments from client 3. The design was well understood as done in the same team thereby ensuring delivery to required standards 4. Costs were all inclusive and made budgeting easy for the client as the budget was all encompassing 5. Early supply chain involvement because of early start to project 6. Quicker to resolve design and on-site problems without client involvement 7. Allowed for innovation in construction methods and designing to cost 8. Early involvement of contractor incorporated his skills in the design and project benefitted from the contractor's constructability experience 9. There were no major claims experienced	1. Costs escalated as construction started even before the designs were complete 2. There is limited expertise available in ZCI 3. Lack of clear cut guidelines from ZPPA ACT (Zambia Public Procurement Authority) as the current does not mention the method 4. The design component of the contractor was limited design and hence this resulted in the delivery of a product that did not meet all the client's specifications 5. All costs due to poor design/omissions were borne by the contractor and this greatly disadvantages the contractor 6. Bringing together a team to undertake the whole process was difficult and costly 7. Weak management capability on contractor's part posed challenges with management of project 8. Limited assurance of quality control 9. Highly technical staff were required and this meant more cost for human resources
CONSTRUCTION MANAGEMENT (CM)	
Advantages encountered	**Barriers encountered**
1. Management of the project was well coordinated as there was single point of project management 2. Work was done at a faster pace as all sub-contractors were specialised in their particular work sections 3. Easy to identify and work with different specialised contractors 4. Time efficiency – project delivered on time 5. Different stakeholders at different stages was good for transparency – design team different from construction team 6. Costing of activities was easily monitored and rescheduling of activities had less effect on overall cost	1. There are no clear cut guidelines from ZPPA on the method 2. Too many people to work with and this was difficult to manage at the end of the day efficiency was lost and delays come in 3. Liaison between the different parties lengthened the delivery period 4. Construction team took advantage of an overwhelmed supervising team and thus delayed in completing the project. 5. Work delayed because of misunderstandings among the many parties involved in the project
MANAGEMENT CONTRACTING (MC)	
Advantages encountered	**Barriers encountered**
1. Single point responsibility for payments and communications 2. There was cost saving by the client 3. Responsibility lies with management contractor 4. Work moved fast because of specialised contractors	1. There are no clear cut guidelines from ZPPA on the method 2. There is lack of appropriate knowledge on the method 3. There was no direct contact with the client 4. Late or delayed payments to sub-contractors by management contractor
PARTNERING	
Advantages encountered	**Barriers encountered**
1. The client is given the project without much involvement 2. ZPPA has sanctioned the use of this method for public works 3. There was good transfer of skills	1. The client has no control over the budget so method not very favourable 2. The client had no control over time taken to complete the project 3. Contractor did not fully understand the benefits

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4. Access to prime land and facilities 5. Innovation in construction finances was exhibited as clients could develop without having the finances required 6. There was no need for receiving party to provide money for development 7. It was found to be more suitable for big projects and client was not under pressure for funds 8. Innovation in construction scheduling, finances and methods was encouraged	4. There was difficulty in agreeing the transfer period and the benefit to the client during the concession period 5. No control over quality and time by the client/user

Source: Research 2013

7.3 The Chi Square Test of the Hypothesis

Since χ^2 was computed as 19.17, which is greater than 5.991, the value for χ^2 for 2 degree of freedom and confidence level, $\alpha = 0.05$, then the null hypothesis was rejected at 0.05 level of significance and the alternative hypothesis is accepted and proving the adopted hypothesis as correct. In view of the test, the poor project performance in the ZCI among consultants, contractors and clients are a result of the lack of use of the alternative procurement methods.

8.0 Conclusions and Recommendations

8.1 Conclusions

The conclusions from the research were:

1. The main project performance deficiencies in the TPM which contribute to non-delivery in terms cost, time and specifications were:
    a. Time consuming processes of design and documentation
    b. Adversarial relationships between the different parties to the project who all have separate contractual relationships with the client
    c. Buildability problems during the construction phase leading to variations and increase in cost and time and quality may also be affected
    d. Lack of innovation in the construction project is managed i.e. no innovation in construction methods, construction scheduling or finance.
2. Some of the causes of project performance deficiencies in the TPM were identified as;
    a. Late involvement of the contractor in the construction process leading to buildability problems and compromise on quality.
    b. The sequential nature of the TPM means that a lot of time is required for the project to be completed, leading to time and cost overruns in most cases
    c. Disputes which usually occur because of the adversarial relationships in the method, lead to time and cost overruns
    d. The TPM has methods and contracts that have been used for a very long time and they do not allow for innovative ways of doing things.
3. The three main types of APMs which are D&B, management methods (CM and MC) and partnering mostly came about because of the high level of dissatisfaction from the TPM by the players in the construction industry.

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4. The various attributes of the APMs can be used to improve project performance.

5. Some of the barriers encountered by the players in the ZCI in the introduction of the alternative procurement methods were found to be as follows:

    a. The ZPPA ACT has a set list of methods that can be used for these works. The methods are the traditional and the Private Finance Initiative (PFI). Special permission has to be granted by ZPPA for the other methods to be used. This has been seen as a bottleneck to the use of the alternative methods.

    b. The low levels of knowledge in the ZCI on the APMs mean that the methods have gone unused.

    c. There is generally a perception amongst the players in the industry that the alternative methods are more expensive than the TPM.

    d. The expertise in the industry on the alternative methods seems to generally be low as compared to the expertise in the TPM.

6. The use of APMs is still in its infancy in the industry but there are indications that this will change in the future.

7. A relationship exists between the poor project performance and the non-usage of the APMs. The research indicated that poor project performance can be countered by the use of the alternative methods.

8.2 Recommendations

In view of short-comings of the TPM, the following recommendations are being made to improve project performance and encourage the use of alternative procurement methods:

1. The National Council for Construction (NCC) and the ZPPA as the regulators in the ZCI should encourage the use the APMs to deal with dissatisfaction with the TPM. The ZPPA ACT would have to be amended to include the use of all the APMs.

2. The NCC should disseminate information, online or through the regular stakeholder meetings. The EIZ, ZIA and SIZ, should also sensitise their members on the alternative methods available, through conferences, meetings and publications.

3. ZPPA as a regulator of procurement for Zambian public procurements should sensitise the industry on APMs, as provided for in the ZPPA Act.

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MANAGING ELECTRICAL INSTALLATION RISK ON LOW SKILLED CONSTRUCTION SITES

Willem du Toit

Abstract

The increased usage of electricity on construction sites requires more complex electrical installations, posing unique risks especially on sites with low skilled workers and more so in third world countries where knowledge in relation to electrical hazards is limited.

Electrical installations on construction sites are more dangerous than in completed building installations, this due to an altering environment that does not always afford the luxury of testing and certification when changes are made to such installations, to accommodate changes in construction phases. Such installations can be fatal when unskilled labour are exposed to them, when knowledge, heuristic learning and experience lacks in identifying hazards of such electrical reticulation and components, that do not comply with basic electrical engineering health and safety (H&S) standards in relation to protection and method of installation.

The purpose of this study is to determine the prevalence of unsafe electrical installations on construction sites, the knowledge base of electrical workers in identifying electrical hazards and basic understanding of risks in relation to electricity usage on construction sites in South Africa. Recommendations are made on correct H&S management interventions that can ensure minimum preventative safety measures for construction workers, should such installations not comply with acceptable engineering H&S standards.

Keywords: Electrical construction installations, electrical hazards, health and safety (H&S).

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1.0 Introduction

Management of H&S on construction sites aim to identify all risks during the various phases of a construction and to develop mitigating procedures to limit risk identified. Construction sites continually change so it is difficult to predict what it will be like at any point in the future (Wadick, 2010). With every alteration and new addition to a building project being constructed, the risk changes and requires a change in risk mitigating H&S procedures.

Electrical risk management on construction sites requires not only sensory analyses of the risk involved, but due to its scientific properties, also knowledge of the properties of electricity and electrical engineering standards, to ensure correct selection and installation of conductors, switchgear and equipment. Further, knowledge of the dangers of high voltage reticulation is required especially when there is exposure to open live circuits such as high voltage overhead lines.

1.1 Review of the Literature

1.2 Electricity usage on construction sites

Electricity as a form of energy used in construction activities has only recently been fully exploited, especially on African construction sites. Safety issues have always been a major problem and concern in the construction industry. Efforts have been made to address this problem, but the results have been far from satisfactory, as construction accidents continue to dominate (Teo *et al*. 2005). Manual labour and to a large extend the usages of fuel driven vehicles and machinery still make up the bulk of labour and machinery assistance on these sites. However, with increased demand for sophisticated equipment requiring electrical supply - such as measuring and related computer base equipment - access to and the availability of temporary electrical installations have increased. Further contributing factors for the availability of electricity on construction sites are alternative energy sources, including standby generation and photovoltaic (PV) electrical supply, although the latter as a form of electrical supply is relatively new. With the expansion and electrification of electricity grids, especially in South Africa, the connection to local utility grids has in recent times become much easier for construction sites. The role of the complete electrical team, from designers to electrical installers plays a critical role in correct selection and installation equipment that will ensure an H&S construction environment. Babalola and Adesanya *(*2008) indicated that electrical project technicality comprises of the type of structure, method of installation and location of the site. Economic requirement comprises of market condition and a firm's workload while contract requirement consists of form of procurement and type of client.

Unfortunately, a large percentage of the workforce, in African developing countries, are not knowledgeable regarding hazards related to the usage of electricity with limited training or heuristic learning exposure of electrical installations. Although construction site electrical installations are usually low voltage installations (220 Volt), exposure to medium and high voltages, above 1000 Volt, do occur in the form of overhead distribution lines and underground cables. Electrical signage as a form of communication on electrical hazards is

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of utmost importance for non-literate workforce. Such signage not only communicates hazards in relation to existing electrical installations but also instils a safety culture.

According to De Silva and Wimalaratne (2012), signs and symbols with pictorial illustrations and colour were able to attract the workers attention and subsequently improve their work safety behaviour. It was expected that participants would comprehend safety signs better if the signs were familiar to them. As physical signs provide a direct visualization aid in helping participants to elicit the meaning, they were expected to yield higher comprehension scores than abstract ones (Chan and Chan, 2011).

1.3 Risk of construction site electrical installations

Due to construction sites continuously changing by nature, electrical installations should be flexible but still afford higher safety aspects than fixed installations. Electrical hazards on construction sites not only relates to the possibility of electrical shock but also that of electrical arch burns due to high current short circuits, and indirect burns from exploding electrical switchgear. Risk is a natural consequence of uncertainty and is part of human activity. It means different things to different people and is intimately linked to personal or collective psychology. It is a composite idea, bringing together: likelihood (chance) and the probability of an adverse event, consequences and context (Stillman, 1997).

If construction workers do not comprehend risk associated with electrical usage and the dangers of unsafe electrical construction installations, electricians and other electrical construction workers that are responsible for such installations, not only endanger their own lives but also that of all construction workers and persons having access to such site. Socio-economic aspects should also be considered. In this study, respondents indicated that financial provision for H&S would greatly contribute to the improvement of H&S implementation. Many contractors currently face diminished incentives to allow for H&S in their tenders. It is also recommended that contracts should address H&S just as they do quality and cost. This will help many contractors, as both contractors and designers will be required to address H&S during the execution of projects (Musonda and Smallwood, 2008).

Due to the lack of competent policing to enforce legislation related to H&S, especially safety standards applicable to construction sites, incidents will unfortunately increase with an increase in the usage of electrical installations on construction sites in Africa. De Silva and Wimalaratne (2012) found that the lack of technology, equipment and inspection by a qualified person are the most probable challenges to improve existing unsafe conditions on construction sites. The availability of competent H&S personnel on construction sites has a direct impact on lowering incidents. Having a qualified H&S officer on a construction site is shown to be an important requirement to handle the H&S at sites, which often poses safety problems unique to their own conditions (De Silva and Wimalaratne, 2012).

1.3.1 Direct and indirect electrical risk

Electrical incidents are not only related to electrical shock but indirect incidents can be contributed to risk of falling, electrical arch burns and explosion of electrical switchgears

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1.4 Risk of falling

Not only are electrical installation workers exposed to electrical installation whilst installing such but most construction activities are performed at heights. Should a worker be electrocuted and be in a position where he is not correctly supported with the correct personal protective equipment (PPE) he may fall, which might be an indirect fatal incident not due to an initial shock but due to a fall, for instance, when working on a ladder or in an awkward position from a scaffold etc. It is such risk of falling whilst exposed to live electrical installations that requires H&S management to ensure correct safety equipment and PPE are used to prevent possible serious incidences from falling if electrocuted.

Rwamamara, *et al* (2010) indicates that H&S safety plans must always include the rules to be applied on a construction site and a description of how health and safety work shall be organised. If the work is to be carried out on a site where other activities will be in progress simultaneously, this is to be taken into account in the work environment plan.

The primary consideration in selection of fall prevention should always be safety of construction site personnel and the general public. However, impact on time, cost and quality of the work that the system is installed to enable, must also be considered (Cameron, Gillan and Duff, 2007).

1.5 Risk of contact with overhead power lines

Construction activities near low, medium and high voltage lines pose unique risks as these lines, depending on their voltage; can cause serious incidents when any objects encroach on their safety clearance space. Such space means that it is not necessarily needed to touch the specific power line but that a flash over can occur when any conductive object creates a path to earth.

In most electrical power line electrocutions on construction, site vehicles, cranes and steel used in reinforcing were responsible for direct or indirect conductive paths for electricity to earth via either a person or construction vehicles and cranes used. Electrical contact with power lines can also energize the ground, spreading outward concentrically from the point of contact. Dangerous voltage differentials can be created by workers walking toward or away from a source of stray voltage. If contact is made with an energized power line while in a vehicle, workers should be instructed to remain in the vehicle. If exiting the vehicle or equipment is necessary because of hazards, or fire, or other safety reasons, the operator should jump completely clear of the vehicle with both feet together and shuffle away in small steps (or hop) to minimize voltage differential between their feet and avoid electrical shock, e.g. “step voltage” (Grosskopf, 2010)

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1.6 Risk of incidental contact with live electrical installations and electric arc's

Probably the greatest potential for serious incidents are live electrical equipment or installations that are not properly installed or are incorrectly housed, live open wiring and electrically live equipment that is not properly grounded with an earth continuity conductor.

Electrical workers must also know about appropriate H&S precautions and project management skills, and not just have a basic knowledge of the task at hand (Higgins, 2011). Workers should never assume that any wire is, or is not, an electrical conductor, or that a wire is safe to touch because it is insulated. Since high voltage electricity can travel or "arc" through air, workers operating aerial equipment should remain at least 3 m away from overhead wires (Grosskopf, 2010).

The possibility of serious burns from electric arch burns increases closer to the electrical source or supply transformer, and should a short occur near such distribution equipment an electric flash arch can develop with the potential for 3rd degree burns. Such risks are usually only for electrical workers and most non-electrical construction workers should not be exposed to such arch flash burns.

2.0 Engineering methods of risk mitigation methods on construction sites

Correct selection and installation

Proper and correct selection of electrical equipment and installation material is of utmost importance. Products must not only be safe to use, but must also provide the user with inherent protection should such appliance or equipment be used incorrectly (Smith and Keeney, 2005). Electrical installations, cables and plug units are exposed to extreme environmental conditions on construction sites and require the correct ingress protected (IP) rating that can withstand wet processes, mechanical damage and dusty environments, affording such equipment and material the kind of protection that will not expose workers to live electrical parts or that of conductive material such as wet cement mixtures or water contact. The cost of managing electrical H&S on site should form part of the total project cost. It is essential for estimators to have a detailed knowledge of the factors that will affect the incorporation of electrical services cost into the overall building project cost (Babalola and Adesanya, 2008).

2.1 Correct earth grounding

Correct earth grounding of all exposed metal parts that may inadvertently become live is important in that such procedures will afford protection to workers by conducting fault currents not through workers but via earth continuity conductors to earth terminals, safely conducting such fault currents away to the earth mass. Workers should not operate portable electric tools unless they are grounded or double-insulated with power supplied from a ground-fault circuit interrupt protected electrical source. Workers should never operate electrical equipment while in contact with water (Grosskopf, 2010).

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2.2 Switchgear and earth leakage protection devices

Earth leakage devices are switchgear used on low voltage installations for protecting people against earth leakage currents, in most cases higher than 30 milliamperes. These devices are probably the most important safety component that will protect people against electrical shocks. The human heart will go into fibrillation when exposed to a current flowing through the body higher than 50 milliamps. Further, the neurological system will be affected when a current of 50 milliamps is exposed to. Fatal electrocution usually occurs at a current higher than 100 milliampere. Given that the average plug and switch unit have an overload capacity of 20 amperes or 20 000 milliamps it can be seen how fragile the human body is when exposed to low voltage installations. Overloading conductors that are not protected with correct overload protection switchgear increases the risk of such conductors overheating, with the possibility of a fire affecting on-site H&S, directly from burns and indirectly from the health of workers exposed to toxic fumes.

3.0 Human behaviour and electrical installations

3.1 Perception of electrical risk

Without knowledge and in most instances heuristic learning experience of risk associated with electrical installations, electrical installation hazards cannot be judged naturally or with human sensory evaluations. It is due to this factor that electrical installations, especially on construction sites with low skilled workers, who have had limited exposure to electrical installations and the usages of electricity, or have only recently been exposed to such, are in more danger of being electrocuted than workers with years of exposure and training on the risks associated with electrical installations.

Sensory impact on behaviour is to be alert or to pay attention to a specific task being performed. The correlation between lack of attention and incidents is well documented and also relates to overload of information, or being distracted from being attentive to a specific task (Dollard and Bakker, 2010). Although the responsibility of ensuring a safe construction environment is primarily the responsibility of the principle contractor, the workforce can assist in identifying possible hazards when empowered with special training to do so.

The responsibility for providing and building the necessary OSH culture, which goes beyond just preventing injuries in the construction sites, is a shared duty among the stakeholders. In a construction site, it can be shared by the workforce and the management, which includes client, contractor and consultant and the government or the relevant authorities (De Silva and Wimalaratne, 2012).

3.2 Training as an intervention

The most crucial intervention in lowering risk exposure to unsafe electrical installations is training. Training can be formal in a class room or during H&S induction training but most is nature during site tool box talks, daily before construction starts. Training as a form of positive reinforcement will motivate workers to act in a safe manner. According to Teo, *et al*.

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(2005) positive reinforcement gives workers outcomes (positive reinforces) they desire when they perform organisationally functional behaviours. According to this theory, to motivate workers to perform their jobs in a safe manner, contractors should offer incentives such as monetary rewards, bonuses and job promotions.

3.3 Personal protective equipment (PPE)

The use of correct PPE, especially during testing and switching on construction sites, is of the utmost importance and will ensure protection in case of an accidental short circuit arch blast or to prevent electrical shock. PPE includes correctly selected rubber gloves and mats and electrical arch flash suites for electricians doing switching and work on, or near, live electrical installations. The occurrence of serious head injuries caused by falls could be avoided and lives could be saved by compelling construction workers to wear the necessary personal protective equipment (De Silva and Wimalaratne, 2012).

4.0 Research Method

The exploratory phase of the study entailed a self-administered questionnaire survey, which investigated construction workers' views of the risk involved in electricity usage on construction sites. An evaluation of individual profiling in relation to heuristic learning and exposure to electricity and such workers scholastic level and knowledge of basic electrical terms used on construction sites are evaluated.

4.1 Research Findings

4.2 Sample Stratum

The sample stratum consists of a questionnaire forwarded to construction workers on 12 construction sites in Gauteng and the Eastern Cape area of South Africa. 43 completed questionnaires were received with a 26 % response rate.

4.3 Research Survey

The research survey assessed the profile of H&S management on site in relation to electrical installations and knowledge of electrical installation hazards on construction sites, in terms of the knowledge and experience of the sample stratum.

Table 1 indicates that 60 % of workers surveyed have only a primary or secondary school qualification and that only 17% a degree or diploma with 23 % being artisans. This would be an acceptable profile of construction workers in South Africa indicating the level of theoretical training received in terms of electrical installation hazards. The indication by most of the respondents that they do not reside in an informal settlement and that most have electricity supply to their residences is an indication of the changes in South Africa and that most workers should be aware of electrical hazards not only at work but also at home. Although 28% of workers were only exposed to electrical installations after the age of 10

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years this would have afforded them the opportunity of developing a knowledge base of the hazards associated with the use of electricity, empowering them to identify unsafe electrical installations to a certain extent. The low percentage of workers (8%) that made construction their life career can be a contributory factor to inferior knowledge of electrical hazards on construction sites, and not that they do not understand the unique environment of electricity usage on construction sites.

Table 1: Profile, knowledge and competency of targeted construction workers

Profile, knowledge and competency											
1.	Scholastic and other qualifications	Unsure	Primary school	Secondary school	Trade Certificate	Diploma	Degree				
		0%	25%	35%	23%	10%	7%				
2	Primary resident	Formal settlement		92%	Informal settlement		8%				
3	Electricity installed at home	Use electricity at home		97%	No electricity usage at home		3%				
4	Age when first exposed to electricity at home	0 to 10 years	72%	10 to 18 years	18%	After 18 years	10%				
5	What percentage of your working career was spent on construction sites	25 % or less		50% or more		All my life					
		42%		50%		8%					

In Table 2, it is significant that nearly half of the respondents complained of unsafe electrical installations, aspect 1, in comparison to aspect 4, (55%) who received safety training regarding the safe use of electrical installations, presenting a correlation between the impacts of training in reporting unsafe electrical installations. Further, aspect 3 shows (60%) of respondents correctly indicate awareness of correct procedures in fire control due to electrical faults, displaying an understanding of construction workers' knowledge of the dangers of electrical installations.

Signage as a means of conveying electrical hazards is perceived by most respondents (78% in aspect 2) as effective, highlighting the value of this means in H&S communication. The large percentage of respondents that have been involved in or received electrical shocks with knowledge of other people having received an electrical shock, in aspect 8 and 9, is an indication of the risk and exposure people have to unsafe electrical installations. Such experience as a heuristic learning curve can be constituted as knowledge on the dangers of electrical installations, resulting in positive action regarding unsafe construction sites, and can be seen as a preventative measure in relation to the manifestation of fear in being electrocuted as indicated in aspect 6.

The indication that nearly half of the respondents, in aspect 10, believe that electricians doing installation work on site are not qualified and that 85%, in aspect 11, indicate the need for qualified electrical workers and the lack of H&S policing and shortages in competent electrical workforce being experienced in South Africa. Such presentation will only result in

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less compliant unsafe electrical installations. Further indication of lack of trust in electrical workers is shown aspect 13, where 45% of respondents do not trust construction electricians to ensure a safe electrical environment.

The presentation in aspect 12 that more than half of the respondents (58%) indicate that in their community people do not make use of qualified electricians manifests itself on construction sites in that 58% of respondents, aspect 7, are prepared to do electrical repairs although not qualified to do so as electrical workers.

Table 2: Attitude to electrical safety on construction sites

Attitude to electrical H&S on construction sites		**Yes**	**No**	**Unsure**
1	Have you ever complained of unsafe electrical installations?	48%	40%	12%
2	Is electrical installations correctly indicated by signage on site?	78%	18%	4%
3	Can any type of fire extinguisher be used on burning electrical cables?	33%	60%	7%
4	Have you ever received safety training regarding the safe use of electrical installations on site?	55%	40%	5%
5	Is there a difference in first aid required when electrocuted in comparison to other incidents?	58%	20%	22%
6	Are you afraid of being electrocuted on site?	63%	22%	15%
7	Will you fix damaged electrical cables and leads if required to do so?	58%	37%	5%
8	Have you ever received an electrical shock: at home or at work on your construction site?	53%	47%	0%
9	Do you know of anybody that received an electrical shock, at home or at work on your construction site?	47%	53%	0%
10	Are all electricians on site qualified to do the work?	53%	23%	24%
11	Do we need to use qualified electricians?	85%	15%	0%
12	Do people use qualified electricians in your community when requiring electrical work?	58%	30%	12%
13	Do you trust the construction electricians on site that they will ensure that the site electrical installation is safe?	45%	37%	18%

In Table 3, aspect 1 and 2 indicate that only 38% of the respondents understood the concept of electrical current, although 74% indicated that they comprehend that concepts related to voltage are the result of an environment where more emphasis is placed on voltage indicators on equipment and signage, than on current in amperes. The fact that only 63% of respondents are aware of earth leakage devices is an indication of the need for training that should incorporate switchgear and earth leakage safety devices being one of the most critically required components, to ensure that people on construction sites do not receive fatal electrical shocks. Correct cable usages on construction sites, in aspect 4, provides

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proof of experience in incorrect usage and selection of this medium in conducting electrical current by 73% of respondents.

The belief of 38% of respondents and 28% who are unsure, that insulation tape is the correct method of ensuring safe isolation of live conductors in a construction environment is a manifestation of workers becoming accustomed to the norm of this incorrect procedure, on construction sites in South Africa.

Aspect 6 indicates the availability of electrical supply at home and that there is a need for most construction workers to make use of construction outlets to charge personal equipment. The fact that only 58%, in aspect 7, of respondents believe a person can die from an electric shock highlights the critical need for training on the dangers and the effects of electrical current on the human body. Aspect 8 confirms the need for training regarding installation safety methods in relation to correct earth grounding of systems.

Risks involved in wet process with exposure to electrical equipment and installations and the possibility for electrocutions, aspect 9 is well understood by 80% of respondents. Aspect 10 reaffirms aspect 3 in the understanding of the working and need for specific switchgear and is comprehended by only half of the respondents. The low trust in construction management, aspect 11, to provide safe equipment manifests itself in the low agreement and trust to use electrical equipment and appliances provided as being safe.

Table 3: Profile, knowledge and competency of targeted construction workers

	Knowledge of electrical hazards	**Yes**	**No**	**Unsure**
1	Do you know what electrical current in ampere means?	38%	40%	23%
2	Do you know what voltage is?	74%	13%	13%
3	Do you know what an earth leakage device is?	63%	20%	18%
4	Can we use any type of electrical cable of different sizes and colours as long as it works?	10%	73%	18%
5	Is electrically live cable-ends safe if we use insulation tape to insulate such cable ends?	38%	35%	28%
6	Do you use your construction site plug units to charge your mobile phone?	25%	60%	15%
7	Do you think anybody will die on the site if they receive an electrical shock?	58%	13%	30%
8	Do you know what the green or copper earth wire is used for?	53%	30%	18%
9	Is it acceptable to work with wet cement mixtures and other wet construction products near electrical plugs and lighting?	10%	80%	10%
10	Do you know the difference between an earth leakage device and a circuit breaker?	53%	23%	25%
11	Will you use any lights provided to you by the construction supervisor?	43%	38%	20%

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5.0 Conclusion

The use of electricity as a prime source of energy on construction sites will increase and so will the risk associated with electrical installations in such work environments. It is of the utmost importance that correct risk evaluations be made of existing installations on construction sites, e.g. overhead power lines, etc., and that new installations be correctly installed by qualified electrical workers, according to acceptable safety standards.

Subcontractors want to be safe at work, but working safely is compromised by such competing forces as time/money pressures, the nature of the work, the power and position of the main contractor, and the inter-relationships between the trades (Wadick, 2010). Workers, however, need to be educated on the basic principles of electricity usage to understand the hazards of electrical shock and electrical burns, and the dangers posed by construction activities and usage of electricity. Such workers must have the minimum knowledge to refuse to interact with live or unsafe installations and to report such unsafe installations. Construction management must ensure that basic acceptable engineering principals in relation to construction sites are adhered to, especially in relation to the correct selection and installation of electrical components, cables and switchgear, H&S legislation and acceptable electrical safety standards.

Electrical engineering and electrical installations on construction sites are so intertwined with H&S that most of the processes in electrical engineering are to ensure the safety of people and the protection of assets. Due to the dangers of electricity usage and the increase in risk on construction sites, construction electrical installations must afford a greater degree of protection to construction workers than the final electrical installation.

Construction workers, especially on low skilled construction sites, do not always have the heuristic learning or formal training of the hazards of electricity on such sites and therefore require more training and optimal protection especially in terms of wet processes and the protection against incorrect or dangerous electrical installations, installations that could be exposed to mechanical damage of construction activities. Such electrical installations must afford the same and better protection for low skilled construction workers.

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THE IMPACT OF ROAD TRANSPORTATION NETWORK ON PRODUCTIVITY AND GROWTH IN KENYA 50 YEARS AFTER INDEPENDENCE: A REVIEW

Justus N. Agumba[1] and George M. Ochieng[2]

Abstract

Kenya celebrated her 50 years of independence on the 12th December 2013 with economic and policy analysts jotting that in that period the economy had grown nine times. It is a proven fact that development and maintenance of physical infrastructure are prerequisites for rapid economic growth and poverty reduction, as they influence production costs, employment creation, access to markets, and investment. Despite being considered an economic powerhouse in the East and parts of Central Africa Economic block, the size of the roads network, which is perceived to be fairly well developed, has suffered from numerous setbacks. Among these are; inadequate maintenance, repair and rehabilitation (MR&R), and the fragmentation of the institutional framework within which it is managed. This paper aims to provide a review of challenges the Kenyan government has faced on its road network, the impact of the state of the road network on productivity and growth, and the interventions proposed within the 50 years of her independence. This paper is based on an exploratory review of literature on the state of road networks and its effects on Kenya productivity and growth. Inferences from the reviewed literature indicate that the state of road network in Kenya causes delays, breakages and high maintenance cost for transport machinery, leading to high costs of doing business. This has resulted in the concentration of industries in areas with good road network thus creating disparities in regional industrial development. However, the government of Kenya has been developing road polices to improve on the road network. Given that the findings reported herein are inferences deduced from material reported in literature, the factual correctness of some of the intricate indices may not be explicitly verified. However, the general facts may be implied by the existing state of affairs. The paper presents the identified probable causes that have slowed the development of road network in Kenya including their impact and interventions proposed or implemented by the government of Kenya. It expresses an objective overview on literary discourse around the road network in Kenya. The study advocates for policies that will lead the country to achieve her development strategic plan of Vision 2030 on road network development, which the authors view as a catalyst to address the endemic systemic inadequacies that have stifled prudent infrastructure management strategies in the past 50 years of independence.

Keywords: Impact, Productivity, Roads, Network, Development

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1. Introduction

The transport and telecommunication infrastructure subsector in Kenya contributed the highest to the gross domestic product (GDP) of the country for three consecutive years, from 2008-2011. In 2012 it also contributed the highest to the GDP at 9.3% (Kenya Institute for Public Policy Research and Analysis report (KIPPRA, 2013). The subsector also provides the necessary linkages for promoting national and international trade, economic growth, poverty reduction and wealth creation. Road transport accounts for over 90% of Kenya's total passenger and freight transportation (African Development Bank Group, (ADBG, 2014). Kenya experienced rapid expansion of road infrastructure in the late 60's and 70's, largely as a result of high levels of development assistance from bilateral and multilateral agencies (Kasuku and Macharia, 2003).

Since the 1980's, there has been a drastic reduction in support and absence of alternative funds for routine maintenance despite the stated importance of the road sector and the previously experienced rapid expansion. This led to a considerable deterioration of roads, both classified and unclassified. The deterioration of roads has been cited one of the probable reasons for the decline of Kenya in regional competitiveness in trade, industry and commerce (Kasuku and Macharia, 2003). While there is heavy reliance on road transport in Kenya, of the 160,886-km road network of both classified and unclassified, only 7% of this network is paved. This is not economically sustainable as the road network carries 90% of freight and passengers. The total length of paved roads per 10,000 inhabitants in Kenya is currently estimated at 2.19 km, which is less than the East Africa Community member countries' average of 2.53 km (African Development Bank Group, 2014). Recent surveys also suggested that about 50% of the road network in Kenya is in good condition while the balance requires rehabilitation (Ministry of Transport (MoT, 2010)). Similar studies also report that about 30% of Kenya's population live within two kilometres of an all-weather road. This percentage is considered to be well above the benchmark for low-income countries, but only half the level found in middle-income countries (Briceño-Garmendia and Shkaratan, 2010).

Furthermore, the road network, density and conditions vary across the country, which should be addressed (Kenya Institute for Public Policy Research and Analysis report (KIPPRA, 2013). These road networks are overlaid on major settlements as indicated in Figure 1. They are concentrated in the highlands of South Western Kenya. These are the agricultural heartland and areas of highest population density. The highways, primary, secondary and feeder roads are in the Southwest, near Lake Victoria (Briceño-Garmendia and Shkaratan, 2010; de Sherbinin, Adamo and Sydor, 2013). The dryer Northern areas of Kenya are far more sparsely populated and the road networks are less dense. Although some roads are coded as highways, these are in reality mostly two-lane paved roads. Tertiary roads are generally little more than dirt roads or tracks. Furthermore, the World Health Organization indicated that Kenya was ranked 25th highest in the world for the total number of road traffic deaths in 2010 and 45th in road death rate (deaths per 100,000 population) (de Sherbinin, Adamo and Sydor, 2013).

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Based on the aforementioned discussion of the importance and shortcomings of the road network in Kenya, the purpose of this paper is to establish the challenges that the Kenyan government has faced pertaining to road network development 50 years after independence. It also envisages to outline the intervention strategies that have been implemented or proposed as a deliberate effort to realign the infrastructure development strategies to the country's grand Vision 2030 strategic blueprint. In this blueprint, the economy is enshrined as one of its three pillars. The economy is consequently expected to be driven by among other factors; prudent road infrastructure development policies. Hence, the following research questions were proposed:

- What challenges has the Kenyan government faced on its road network 50 years after independence?
- What has been the impact of road network on productivity and growth 50 years after independence? and
- What interventions have been proposed to enhance positive impacts or mitigate against the negative impacts?

2. Literature review

2.1 Challenges of Kenya Road Network

Various transport policy statements are contained in various documents including the National Development Plan (2000-2008), the Poverty Reduction Strategy Paper (PRSP), the Kenya Economic Recovery Strategy, the National Alliance Rainbow Coalition (NARC), Orange Democratic Movement manifesto and vision 2030 blueprint. According to Kasuku and Macharia (2003), generally, commitment to a strategic and broad-based approach to transport planning is gauged by the extent to which a country's roads policies are based on the following fundamental criteria:

- Integration—ensuring that all roads decisions are taken in the context of a coherent, integrated transport policy covering all modes;
- Accessibility—making it easy to reach destinations;
- Safety—making travelling safer;
- Economy—getting good value for money and supporting sustainable economic activity in appropriate locations;
- Environmental impact—both positive and negative, on both the built and the natural environments, and at the global, regional and local levels; and
- Tackling road congestion.

Against these criteria, the issue that has affected road transport sector in Kenya as cited by Kasuku and Macharia, (2003) is lack of coordination that is; it is difficult to coordinate the activities of the various road agencies, to determine their financial requirements, and to address the problems of the road sector in a synchronized manner. The general high value of roads as compared to railways and air travel provides a raison-d'être for ensuring coordinated management with access to adequate funds to ensure the large investments in roads yield value-for-money operations. However, funding estimates have been far higher than what is available and allocations from government resulting in inadequate maintenance and rehabilitation of roads. This has led to most paved and unpaved roads to deteriorate

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significantly through a lack of maintenance, repair and rehabilitation. Furthermore, the main paved road networks are being overloaded by vehicles. Besides the overload, traffic growth has resulted in a substantial network of unpaved roads carrying traffic levels that would otherwise justify paving the roads. In this regard, it is estimated that about 2,500 km of unpaved roads carry over 200 vehicles per day. Congestion has also been deemed a challenge, particularly in major urban areas that are characterized by heavy congestion during peak hours, over-loaded public transport vehicles, speeding, and reckless driving. Consequently, the cost of road transport in Kenya has been considered to be extremely high as a result of physical damages and death incurred through accidents. It is estimated that the average death rate on Kenyan roads is approximately seven persons a day comparable to the Netherlands which has a similar rate but its vehicle density is at least 10 times higher than Kenya's. Kasuku and Macharia (2003), also state that lack of a comprehensive and integrated transport policy framework implies that the overall policy framework does not consider the impact on land use, the natural environment and local public finance. Sustainable development demands that the country must develop a road policy strategy that accounts for other transport sectors and the overall development concerns of efficiency, equity and environmental sensitivity.

In a study conducted by Winiecki, (2008) the current state of roads outside of Kisumu particularly the main artery connecting the city with Nairobi and Mombasa is the biggest infrastructure constraint to business activity in Kisumu. Two thirds of respondents (14/21) recognized poor quality of roads as the most detrimental infrastructure limitation preventing their businesses from reaching their full potential. The study further attributes the poor state of major roads in Kenya to the following: low levels of government investment in road construction and maintenance thereof; high levels of heavy-truck traffic on the Mombasa-Nairobi-Kisumu route carrying goods that could otherwise reach destinations in Western Kenya and other East African countries via rail and lake transport, if appropriate investments were to be made on the appropriate modes of transport; and politically motivated spending of scarce transportation infrastructure ring-fenced resources in politically correct regions of the country.

Odero and Njenga, report (2005) indicated that there is no maintenance policy for Kenyan roads despite apportioning specific road classes to particular agencies. Furthermore, the report states that revenue for road maintenance remains a challenge due to the level of resources in the constituency development funds which was insufficient for rural roads and other transport infrastructure. It is their recommendation that such funds should be increased to sufficient amounts so as to meet the targeted maintenance goals. They further discerned other pitfalls among them; the lack of adequate quality control in road execution, misuse of road facilities, lack of adequate research in roads and related systems as well as lack of delivery systems for comprehensive routine maintenance of Kenya's roads. These challenges are further exacerbated by limited finance to implement the road polices effectively.

The Kenya Rural Roads Authority report (2012-2013) indicated that the challenges experienced in managing rural access roads were mostly competency related. In the report, it was identified that the constitution of the constituency roads committees were

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inappropriate and inept. The membership of such committees included a number of technically inexperienced members with little knowledge of procurement laws and regulations. Consequent to such ineptitude were the following: increased overhead costs, less cooperation from local authorities over road works, large conflict of interest due to bigger groups involvement, inadequate supervision capacity, the transition into the devolved government structures, and challenges of road classifications into national and county roads among others.

Briceño-Garmendia and Shkaratan (2010) indicated that Kenya faces a huge rehabilitation backlog that must be addressed before the trunk network can be considered to be in a maintainable condition. As of 2006, the level of capital spending for the roads sector in Kenya was approximately 1% of the GDP. This was low by regional standards and fell substantially short of what would be needed to clear the rehabilitation backlog in a reasonable period of time. There is a need for a one-time push on road sector investment to remedy this situation. Systemic issues further affect the country's public investment system. These will need to be addressed to ensure that any major scale-up in capital expenditure is cost-effective. Road investments have been characterized by low rates of budget execution (about 60% of the 2006 budget was spent), cost overruns of as much as 80% over engineering estimates, and lengthy delays that tend to double the implementation period. Furthermore, inadequacies in the system for supervising construction contracts have compromised on quality and shortened the design life of road networks.

Furthermore, according to the Ministry of Transport (MoT, 2010), heavy traffic congestion was identified as a challenge especially during peak hours, and stiff competition for limited road space among motorists, pedestrians and cyclists. Traffic congestion is further manifested in long queues of slow-moving vehicles and long waiting times, particularly in Nairobi and Mombasa. Poor physical planning has led to scarcity of parking space in the Central Business District, especially in Nairobi.

The Ministry of Roads (MoR, 2012) identified challenges gazetted in the road sub-sector policy document. These challenges included: non implementation of the drafted Integrated National Transport Policy which was prepared in 2009, hence led to the lack of integration of transport modes; lack of a national spatial plan that resulted in haphazard development; the available funds currently for development and maintenance of roads are inadequate, therefore a substantial part of the road network is not sufficiently attended to, resulting in huge maintenance backlog.

Apart from the identified challenges, there are also concerns over sustainability of Road Maintenance Levy Fund given the emerging issues relating to consumption of petroleum products by non-road users. The report also indicated that there exists an inappropriate modal split, that is; according to the Nairobi Urban Transport Master Plan study carried out in 2006, walking of pedestrians' accounts for 47% of the modal share in Nairobi, hence non-motorised transport facilities have not been adequately provided. Low volume of public service vehicles are inordinately high (29%) as compared to the high volume vehicles (4%), thus increasing traffic congestion and reducing efficiency. Road safety management is also fragmented across various institutions, therefore resulting in poor coordination which leads

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to high numbers of road accidents. Lack of effective road classification system is in existence, given the provisions of the Constitution. Other challenges were: capacity, that is; institutional and technical know-how, lack of axle load control, road reserve encroachment, high cost of land acquisition, high cost of hire of road construction plant and equipment, inadequate legal framework for private sector participation, and volatility of foreign exchange to road network investment.

The African Development Bank Group (ADBG, 2014) suggested a number of challenges which continue to undermine the sustainability of investments in the transport sector in Kenya. Key among these are: funding shortfalls which has resulted in a maintenance backlog estimated at about 20-30%; overloading, notably on major highways; inadequate institutional capacity for road maintenance, especially for the newly established devolved agencies; and continued lack of road safety. Despite these challenges, some governance issues in the transport sector persist including: lack of clarity in division of responsibility amongst transport related institutions governed by the Kenya Roads Board (KRB); weak accounting systems and record management coupled with lengthy procedures for payments; inadequate stakeholder participation in decision making, inappropriateness and ineffectiveness of the institutions in the sector; and absence of proper complaint mechanism. The road network with the neighbouring countries is under pressure, because of the poor road condition. Furthermore, the devolution process which came into effect upon the promulgation of the new constitution in 2010 is underway but faces challenges. This is exacerbated by human capacity constraints and large budget deficit.

2.2 Impact of road network on growth and productivity

It is a proven fact that development and maintenance of physical infrastructure are prerequisites for rapid economic growth and poverty reduction, as they influence production costs, employment creation, access to markets, and investment. However, the First Medium Term Plan (2008-2012) to enable achieve Vision 2030, supported by the Ministry of Industrialisation (2010), indicated that the poor and dilapidated state of transport infrastructure in Kenya has led to low productivity, high production and distribution costs and uncompetitive products and services. Further, the road networks in Kenya are concentrated in a few urban areas, with limited feeder roads in regions with resources endowments. This has resulted in the agglomeration of industries in areas with good road networks thus further creating disparities in regional industrial development. According to the Ministry of Industrialisation (2010) the poor state of the road network causes delays, breakages and high maintenance cost for transport machinery leading to high costs of doing business. This has also resulted in the concentration of industries in areas with a good road network thus creating disparities in regional industrial development.

The MoT, (2010) indicated that the inefficiency in urban transport due to poor road infrastructure has resulted in high transport costs for both passengers and goods. The majority of low-income urban workers currently find public transport costly and financially inaccessible and hence meet most of their transportation needs through walking and head loading. Some of them, however, risk their lives by utilising non-motorised and intermediate means of transport (NMIMTs) (especially bicycles, motorcycles and "*mikokoteni*" i.e. hand

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pulled carts). In addition to poor road conditions in the urban areas, there is a lack of other road infrastructural facilities like footpaths for pedestrians, lack of separate lanes for cyclists or Non-Motorised Transport modes (NMIMTs). Past experience shows that transport policies have largely supported motorised transport at the expense of non-motorised transport and have denied the poor and disadvantaged benefits inherent in NMIMTs leading to marginalisation of NMIMT users in both urban and rural areas.

The ADBG (2014) indicated that family farming has been characterised by low productivity due to inadequate rural roads including other infrastructure components. Furthermore, police road blocks and multiple weighbridges continue to slow the traffic flow and create bribery and corruption opportunities.

2.3 Government of Kenya response to the road network challenges

In an attempt to respond to the challenges faced by the road sector in Kenya. The Ministry of Roads (MoR, 2011), indicates that the government introduced the Road Maintenance Levy Fund in conjunction with the establishment of the Kenya Roads Board (KRB). These initiatives were to fund and manage the road sector respectively. As a further step to facilitate better service delivery, the government established the Kenya National Highways Authority (KeNHA), Kenya Rural Roads Authority (KeRRA) and Kenya Urban Roads Authority (KURA). These agencies were established in order to assist the KRB to manage the different classified roads in Kenya. It is reported that throughout the reform process, the Ministry of Roads (MoR) has shown great commitment and leadership.

According to the Kenya Institute for Public Policy Research and Analysis report (KIPPRA, 2013) the roads sub-sector has been receiving increased budget resource allocation for construction of new roads, bridges, rehabilitation of roads and periodic maintenance as an intervention to improve the road network condition.

Kasuku and Macharia (2003) and supported by Odero and Njenga, (2005) indicated that the GoK in response to the challenges facing the road sector indicated the need to focus in reducing the unit costs of transportation through; infrastructure improvement by coordination of road development and maintenance. This is to ensure that the road network is maintained rehabilitated and or upgraded and expanded to rural areas. Other focus areas identified include: Improvement on road safety and the reduction of congestion in urban areas and on main roads through dualling, fly-over, tunnel grids and bypasses in the main town, and the use of labour based technology for employment creation and foreign exchange savings. Regarding the later for instance, the Rural Access Roads Programme (RARP), initiated in 1974 by the Government was in realisation of the need to place more emphasis on the developmental impacts of road improvements in rural areas. The initiative was based on the premise that rural access roads (mainly unpaved) could contribute immensely towards the acceleration of growth and fostering a more equitable distribution of income in the rural areas. The RARP therefore aimed to provide all-weather access between the farming areas and the market centres and at the same time create employment opportunities by employing labour intensive construction and maintenance techniques. By 1978, a total of 2,500 kilometres of rural access roads had been constructed. This strategy according to Odero and

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Njenga culminated to the Roads 2000 strategy. In addition to the aforementioned focus area, addressing the issue of financial viability and sustainability of fees, to increase funding and ensure adequate cost recovery for efficient and continued maintenance of the road network are also key areas that deed immediate attention.

The ADBG (2014) cited the different intervention the Government of Kenya (GoK) has instituted or proposed. For example in 1999 the GoK established through an Act of Parliament, the Kenya Roads Board (KRB), with a specific mandate to oversee the development and maintenance of the country's road network. The KRB's source of funding is the fuel levy, which has grown fourfold since 2000 with annual collections reaching Ksh 22.5 billion (~USD 0.26 billion) in 2013. Furthermore, the GoK has also initiated other measures to improve the sustainability of road investments, notably the use of performance based contracting, whereby newly constructed or rehabilitated roads are placed under a long term maintenance scheme, and outsourced to a private contractor, with payments based on service delivery. The Kenyan construction industry has geared towards professionalism by instituting the National Construction Authority alongside other non-executive agencies and professional associations. In addition, weighbridge operations on core networks are also outsourced to the private sector so as to enhance efficiency in the regulation of axle loading on the roads. The government has started to introduce road tolling of heavily trafficked highways, such as the Nairobi-Thika Highway. A public private partnership (PPP) framework has also been adopted to lay ground for private sector participation in road development and maintenance. The banks' report suggests that the GoK is considering a further increase in the fuel levy to generate additional revenue required to reduce the road maintenance backlog; and to create an enabling environment for the private sector participation under PPP arrangements. Furthermore, KRB and the National Treasury are planning to float an infrastructure bond to mobilise additional funding for road construction and maintenance.

The ADBG (2014), further indicated that the GoK continues to address transport sector governance issues by taking various actions that include: the outsourcing of weighbridge management and operations to the private sector; setting up of independent tender committees within each road authorities to oversee procurement processes and to ensure that the processes are consistent with best international practices; training of staff from all road authorities on procurement, financial management, and in contract management, so as to address fiduciary issues; separation of the role of engineer and employer in civil works contracts to avoid conflict of interests; and integrating Technical and Value for Money audit services as components in road projects to ensure value for money to the road users and the Government. In line with the aforementioned interventions observed by the AFDB (2014), the Bank has assisted the GoK's efforts to improve governance in the sector by providing finance for recruitment of procurement and financial management specialists for the Kenya National Highway Authority (KeNHA) and professional training to all road authorities in procurement and financial management. The Bank has also introduced Value for Money audits, in addition to the technical audits, for all Bank road projects approved by the Board since 2011. The Bank is also under discussion with KeNHA to reduce non value adding steps in the payment processes.

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3. Research methodology

A literature review was undertaken based on facts and findings as documented in conference papers and proceedings, journals, professional reviews and government reports to discern and collate the relevant information regarding the challenges of road network in Kenya and their probable impacts on productivity and growth for the past 50 years of her independence. The review also identified methods used to improve the state of the road network in Kenya. In order to address the aforementioned challenges the following research objectives were set:

- To identify the challenges faced by the Kenyan government on its road network implementation 50 years after independence;
- To determine the impacts of the state of road network on productivity and growth for the past 50 years of independence; and
- To identify the interventions instituted by the Kenyan government to improve the state of the Kenyan roads 50 years after independence.

4 Findings and discussions

4.1 Challenges faced by Kenyan government on Roads network 50 years after independence

Road sector challenges continue to undermine the sustainability of investments in the Kenyan transport sector, 50 years after her independence. Several challenges have been identified that contribute to the current state of affairs. Among the key challenges established include the following: funding shortfalls which have resulted in maintenance backlog estimated at about 20-30%; overloading, notably on major highways; inadequate institutional capacity for road maintenance, established fragmented agencies; poor planning of the urban road network which leads to congestion, lack of an efficient integrated road network locally, including the neighbouring countries and continued lack of road safety.

4.2 The impact of the state of the road network

Where the road network is in a good condition, it acts as a pull factor for development and consequently there is bound to be an agglomeration of industries in such areas and probably an enabling environment for businesses to thrive, thus creating disparities in regional industrial development. In contrast, poor state of the road network causes delays, breakages and high maintenance cost for transport machinery leading to high costs of doing business. The poor state of the roads coupled with a misaligned transport and traffic regulatory mechanism cultivates a favourable breeding ground for corrupt practices in a bid to do business at all costs irrespective of flouting the rules. This manifest boldly when the law enforcement agencies resort to bribery especially at designated checkpoints (roadblocks) that are meant to ensure the rules and regulations of the road are adhered to. Such rules include: passenger capacity in public transport vehicles, axle loading, and speed limits among others.

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4.3 Kenyan government interventions on road network challenges

In recognition of the various challenges and effects of the state of road network, the Kenyan government is considering to increase the fuel levy with a view to generate additional revenue required to reduce the road maintenance backlog; and to create an enabling environment for the private sector participation under private public partnership (PPP) arrangements. Furthermore, KRB and the National Treasury are planning to float an infrastructure bond to mobilise additional funding for road construction and maintenance. These proposals are supported by the ADBG (2014).

5. Conclusions

Road transportation is an essential component for the transportation of raw materials, industrial inputs, finished products and movement of human capital. In Kenya it accounts for over 90% of the total movement of passengers and freight, hence a key infrastructural component for Kenya productivity and growth. It is the only means of access to majority of rural communities in Kenya. In addition, the importance of road infrastructure has been highlighted in the Vision 2030 blueprint. This long-term development blueprint, aims to transform the country into a newly industrialised, middle-income country that provides a high quality of life to all citizens by 2030. However, this discourse had identified different challenges that the government of Kenya has experienced in her first 50 years of independence, for example poor planning of the urban road network which leads to congestion, lack of an efficient integrated road network locally, including the neighbouring countries and continued lack of road safety, poorly maintained roads due to lack of adequate funding, incapacity of employees to name but a few. These challenges have led to negative effects on the road network usage. Such effects include: delays due to congestion on roads, transit and time losses incurred when sending farm produce to the market among others. These have led the government to improve on her management of the road networks by creating the Kenya Roads Board with three subordinate agencies to assist in the development and maintenance of the different categories of roads.

6. Recommendations

In Kenya, like in most sub-Sahara African countries, roads are managed by government departments. The Department of Infrastructure and Transport which is the department in Kenya responsible for roads network should play a major role in order to ensure vision 2030 is achieved. As we start another half century after celebrating 50 years of independence, Kenyans would love to see a better 50 years in her road network. In order for this to be achieved this paper proposes the following recommendations to be incorporated with the current road policy:

- Political good will from the politicians;
- The government should delink the development of Master plans from politics in order to formulate blueprints that reflect a futuristic and collective realm;
- The government agencies that have been formulated with the Kenya Roads Board should perfect the implementation of the roads projects and should be honest with their implementation;

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- Employ qualified and competent personnel in the government agencies;
- Ensure proper design of road networks with a futuristic forecast of population growth and the resulting expansion and or development needs;
- The government should ensure transparency on the award of contracts, including the duration of contracts; and
- Ensure the devolution system, of managing road networks within the counties and see to it that they are properly implemented.

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BUSINESS MANAGEMENT: SURVIVAL STRATEGY FOR SMALL-SCALE CONTRACTORS IN THE ZAMBIAN CONSTRUCTION INDUSTRY

Chipozya Kosta Tembo[1], Ephraim Zulu[2] and Michael Kapilya[3]

Abstract

The Zambian construction industry is comprised of more than 70% small scale contractors. With the boom in construction currently these small scale contractors are expected to stay in business in this competitive environment and perhaps move from small-scale to medium scale entities. This can be achieved if a holistic approach that addresses all the necessary parameters of a firm such as; general management, marketing, production and operations, human resource, public relations, and financial management are followed. However the trend has been that these small scale contractors have ended up exiting the industry prematurely. This raises the question as to how these businesses are being run in a business management sense. A questionnaire survey was conducted with the view of identify the business management principles that are being utilised in the industry and to identify challenges faced by the contractors in the industry. The survey reviewed that financial management is poor; marketing is almost non-existent, lack of qualified human resource and poor relations with suppliers and on occasion clients due to the quality of the work produced.

Key words: contractors, small-scale, business management, principles

1. INTRODUCTION

The Zambian Construction Industry (ZCI) comprises diverse groups of interacting sectors referred to as sub-sectors of the construction industry. This study however, focuses on the assembly sub-sector where contractors are found. Every year the national council for council (NCC) registers contractors in various categories depending on their capacity and capabilities to undertake works of varying value. Three broad categories of contractors can be drawn from the NCCs registers namely: small-scale, medium-scale and large-scale. The last two categories combined are significantly few in number compared to small-scale contractors who constitute over 70% of contractors in the ZCI. Construction is a business and should be run as such.

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Though large numbers of new small-scale contractors are registered each year, many of them fold up their business activities due to a combination of reasons. Among the chief reasons for high business failure rates amongst small-scale contractors are: failure to compete on the market, financial indiscipline, a lack of knowledge of the industry trends. Amongst those that remain in the industry, a good proportion fails to perform satisfactorily despite getting construction contracts. They fail to deliver projects on time and within required specifications, and also lack financial and managerial skills necessary to run their businesses as going concerns. The research explored the extent to which business management principles are employed by small scale contractors to understand why the failure rate for these entities is high and to provide avenues for mitigation.

1.0 SMALL SCALE CONTRACTORS

According to the National Council for Construction of Zambia a small-scale contractor is defined on the basis of labour. Thus there are groups that define the class of each contractor. The groups are from 1-6 of which the small scale contractor is one found in group 5 to 6. Group 5 handles work worth K1billion Kwacha (old currency); and group 6 handles work worth K250 million (old currency).

Shakantu *et al* (2006) explains that the Small-scale business sector consists of either family owned businesses employing very few people or self-employed people. Chilipunde (2007) also argued that the Small-scale contractor is a typical sole-proprietorship firms, in many cases, a family-owned business with few foremen and mostly casual labour employed as needed. “Small scale enterprises are defined as businesses which, though mainly owner managed, employ between 5-10 and 100-200 people respectively. In the main, Small-scale contractors fulfil all the trappings of formality.

Edmond and Miles (1994) investigated the role that Small scale contractors play in the construction industry in developing countries. The growth of a country is linked to an increase in productivity of Small scale contractors in the construction market. USAID (2009) opined that in many countries, microenterprises - small, informally organised commercial operations constitute the majority of businesses. The Small-scale sector’s influence on individuals, households and national economies is clear and profound.

Dlungwana and Rwelamila (2003), and Rebelo (2005) stated that the construction industry and Small-scale contractors play a significant and critically important socio-economic role in developing countries. It is therefore important that Small-scale contractors be well equipped to effectively manage their construction enterprises from the perspective of the environment, health and safety, as well as from business sustainability, which contributes to the socio-economic development of local communities and society at large. Small-scale contractors have advantages over their large-scale competitors. They are able to adapt more easily to market conditions given the flexibility of their businesses.

1.1 Challenges faced by small scale contractors in the construction industry

The small scale contractor like any other entity in business faces numerous changes. Some of the challenges are due to the nature of the entity, due to policy, behaviour of players in the market, economic c and market conditions. The following are some of the challenges faced by contractors Rwelamila (2002), Crosswell (2001,) Mphahlele (2001), Ofori (1991)and Wijewardena and Tibbis (1999) Inadequate finance and inability to get credit from suppliers, inability to employ competent workers; poor pricing (Chilipunde (2007), tendering and

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contract documentation (Cattel, 1993); poor mentoring, poor training, lack of resources for work-equipment and technology (Muhariwa, 2007; and Kayanula and Quartey, 2000); lack of technical, financial, contractual and managerial skills and late payment. ILO (2006) and Mentor (1985) cited deficiencies in planning and management skills, poor record keeping as challenges faced by small scale contractors. In addition delayed payment and non-payment have led to contractors to delay or suspend work (Kapulula, 2008; Uriyo *et al*, 2004 and Buys, 2006).

By default the small scale contractor is not capable of carrying out complex and very large projects. The packaging of the work for small scale contractor is yet another challenge (Materu, 2002) were work packaged for a small scale contractor is of the magnitude of a medium scale or large scale entity. In addition more often than not work suitable for small scale contractors is floated by open invitation to all registered contractors. The quality of work and the production period of works by small scale contractors is usually unfavourable to clients' hence sometimes opportunities for work are scarce (Muhuriwa, 2007).

Behaviour of major players such as policy makers sometimes is unfavourable for small scale entities in the construction industry. This is well depicted in the study done in Tanzania by the Tanzania Civil Engineering Contractors Association (2003) were foreign contractors were paid more than the local for the same volume of work. The Zambian scenario has been the preference for foreign contractors at the expense of the small scale contractor.

2. BUSINESS MANAGEMENT PRINCIPLES

Business management principles are requisites that together make up the working of a business/organisation. The six dimensional principles include; general management, financial, marketing, human resource, production and operational, and public relations management. In addition business ethics, which are a must for every business and can be considered as an additional principle but not investigated in this study.

The main purpose of business management is to hold a business to the economic principles. The task of business management will emanate from the need of how a business could achieve the highest possible output (profit) with the least possible input (labour, capital, land). More precisely, it entails the assessment of factors, methods and principles that enable a business to function as productively as possible in order to maximize its profits (Cronje, et al., 2000:23).

2.1.1 GENERAL MANAGEMENT

General management is very different from other management functions in that it integrates all of the management functions. In other words it coordinates all the remaining management principles to ensure their efficiency. General management can be divided into three levels namely: top, middle and lower management. Top management consists of the persons and/or figures that are responsible for managing the whole enterprise: Spoken of metaphorically the board of directors which is the highest management board of the business (Cronje, et al., 2000: 104-105; Marx, et al., 1998: 355-356).Middle management consists of mainly the functional managers such as the production manager and the marketing manager. They ensure that those responsible for a particular role perform respective tasks (Cronje, et al., 2000: 104-105; Marx, et al., 1998: 355-356). Lower level management also referred to as supervisory management includes the first line managers who lead the different sections within the enterprise. They usually consist of sectional heads; and sections would include the marketing section, financial section, transport section etc. (Cronje, et al., 2000: 104-105; Marx, et al., 1998: 355-356).

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General management is considered as the overriding function that controls the management process and the general principles of management applied by top management. Top management consists of those persons or groups who are responsible for managing the whole enterprise (Cronje, et al., 2000: 30-31; Jewell, 2001: 19-23; Marx, et al.., 1998:29-31). Principally the number of management levels is largely determined, however not strictly, by the size of the business or organisation. A sole-proprietorship business has only one level of management, in which the functions of upper, middle and lower management are combined in one person who is the owner. On the other hand, very huge organisations that employ hundreds of workers may well constitute far more than three levels of management (Cronje, et al., 2000: 105).

2.1.2 MARKETING MANAGEMENT

Burtonshaw-Gunn, (2008: 103-104) gives two definitions of marketing management from the standpoint of two respective institutions. Marketing management has been defined by the Chartered Institute of Marketing as: the management process responsible for identifying, anticipating and satisfying customer requirements profitably. Similarly the American Marketing Association has defined marketing management to be; the process of planning and executing the concept, pricing, promotion and distribution of ideas, goods and services to create exchanges that satisfy individual and organizational objectives. From the two definitions of marketing two things can be identified which are the four “P’s” (price, product, place and promotion) of the marketing mix model and the other definition shows the later linkage to market research and consumer requirements. Therefore marketing management has the task of combining the four marketing instruments, i.e. product/service, price, distribution and marketing communication.

According to Cronje, et al. (2000: 176) marketing management uses four variables for decision-making: The service itself; the place where it is offered for sale (distribution of service); the marketing communication methods used to inform clients about the service; and the price that reflects the service’s value to clients. Platforms of marketing that are available for small-scale contractors would include bill boards which will cover the type of service offered, the place and the type of labour involved. The four variables, also known as the four “P’s” of the marketing mix, are product (service), place, promotion, and price. The decisions about the use of the four P’s result into marketing strategy, directed at specific clients in a specific environment (Cronje, et al., 2000: 176). Methods of a firm marketing its self-include advertising in both public and private media in form of newspaper, bill boards, magazines, radio and television (Kotler, 2011).

2.1.3 FINANCIAL MANAGEMENT

This section of management is mainly concerned with the flow of funds, and the acquisition of funds, the application of funds for the acquisition of assets as well as the administration of and reporting on financial matters. Financial management is responsible for the efficient management of all facets of the financial function. Financial management has within the broad framework of the strategies and plans of the business making highest contribution to the objectives as its major objective (Cronje, et al., 2000: 30-31; Jewell, 2001: 19-23; Marx, et al., 1998: 29-31). The long term objectives of the business should primarily be to increase the value of the business and that may be accomplished by investing in assets that add value to the business and keeping the capital cost of the business as low as possible.

On the contrary for most contractors growth of business does not seem to be their first priority as this is seen in their attitude to treat business as a fundraising venture. The goals of a business and/or organisation will include the according to Max, et al. (1998: 587-589) the following profit maximization; rate of return maximization; and Maximization of shareholder’s wealth. The roles of an accountant and/or financial manager will include the

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following: financial analysis, planning and control; management of assets; management of liabilities; and provision of financial services. The tools at the disposal of the account/financial manager include income statement; Balance sheet; The flow of funds statement; financial ratio's; liquidity ratios; solvency ratios; profitability, rate of return or yield ratios; and Financial summary with concluding remarks (Cronje, et al., 2000: 299-308).

2.1.4 PRODUCTION AND OPERATIONAL MANAGEMENT

Production and operational function refers to the function aimed at executing the transformation process. Operations management is very cardinal in that it improves productivity, assists the business to satisfy the needs of its clients more effectively and important to the general reputation of the business. Production and operations management is the section in the business that is continuously transforming resources into services. The optimal objective of production and operations management is to achieve the best rate of return on the capital invested in the business. Productivity could be expressed in the following equivalence: Productivity= Output (product quantity)/ Input (resource quantity).

There are ways in which a business can increase its productivity and Marx, et al., 1998: 440) in their research have outlined the following: proportionally increase turnover and resources; Increase turnover with the same resources; reduce resources and maintain turnover; or Reduce turnover using less resources. The production and operations management is usually very efficient with the application of tools such as project management. However, the transformation process of resources into services in order to meet client's demand and value for money among small-scale contractors is very poor. In most cases small-scale contractors are producing substandard works; they fail to finish work on time and some instances they do not finish works at all. In order to attain to good production and operational management, and be able to attain client's value for money, proper project management should be employed.

This production is not a matter of arbitrary choice of the capitalist-entrepreneurs, but an investment to improve product quality and to respond to the ethical orientations prevailing in society, in particular, among employees and customers. It is driven by the profit motive in a competitive environment (Hulsmann, 2008).

2.1.5 HUMAN RESOURCE MANAGEMENT

The owners of successful businesses have developed an Organizational Structure that functions as a well-oiled machine. Training, job enrichment programs and incentive compensation plans are designed to encourage each associate to excel. Successful owners view their associates as their most valuable asset and resource. On the contrary owners of small-scale contracting firms do not seem to consider their workers as their most valuable assets. What most contractors are interested in is the desired result of an assignment without really taking keen interest in executers of works. Resources will include both natural and human. In a research by Cronje et al. (2000: 439), noted to be one of the most important resources in any business are personnel, or employees. Furthermore, Marx et al. (1998: 472) contributed that human resources are critical asset and production factor of the business/organisation.

The main role of human resource management should be that of a strategic partner, and human resources strategies should clearly demonstrate the organizational strategy regarding people, profit and overall effectiveness. It is the task of the human resource manager therefore, to help other managers in the business to make full use of the employees allocated to them. Managers should always focus on recruitment, selection, training, developing, rewarding, assisting and motivating employees (Cronje, et al., 2000: 30-31; Jewell, 2001: 19-23; Marx, et al., 1998: 29-31).

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There is a distinction between the management of human resources and human resource management. Human resources management, however, is a specialized management area just specifically to management personnel (Cronje, et al., 2000: 438). A further argument by Cronje, et al. (2000: 40) and Marx, et al. (1998: 474) is that human resources management has three dimensions namely; human resources provision and maintenance, and developing human resources. There is much need for small-scale contractors to invest in training and developing their personnel's. Most of the workers in small-scale contracting firms are semi-skilled and unskilled; therefore this really calls for serious training to obtain desired result.

The following ethics consist what may be considered as an effective human resource management (Smedley, 2008):

- In reward management: ensure fairness in allocation of pay and benefits.
- Ensure a safe working environment in both for all employees.
- Ensure that procedures are not unduly stressful, and that the needs of employees' work–life balance are not compromised.
- Ensure there are training and capacity building programmes to equip personnel's.
- In outsourcing and off shoring: ensure that contractors, consultants and franchisees are fair and honest in their dealings with employees, clients and customers.

2.1.6 PUBLIC RELATIONS MANAGEMENT

Public relations management is defined as a "deliberate, planned and sustained process of communication between a business and its public for the purpose of obtaining, maintaining or improving good relations with regard to goodwill, mutual understanding, acceptance and cooperation on which profitable survival and growth depend" (Cronje et al., 2000: 241). This is a clear indication that public relations management is pivotal to both the survival and growth of a company.

This is so much concerned about how a firm is able to build and sustain relations with the public in order to grow a firm. The following are the ways in which public relations can be conducted (Harrison and Galloway, 2005):

- Recognize the skills, knowledge, and expertise of other practitioners; and that we
- Learn from those who know more and have greater experience than we do.
- Push ourselves to the limits of our capacities; and that we
- Be prepared to challenge existing practice in the interest of extending the practice, despite institutional pressures against such critique.
- Be able to accept criticism; and that we
- Learn from our errors and mistakes.

3.0 METHODOLOGY

The research was both qualitative and quantitative. The study utilised a questionnaire survey due to it being cost effectiveness, time saving nature and its ability to cover a wide geographical area (Gray, 2009, Cresswell, 2009).The nature of the questions used in the questionnaire were closed questions for quantitative analysis and open ended questions for qualitative analysis. The population of interest were contractors in grade 5 (23) and 6 (68) as these are the small scale contractors. The response rate was 91.3% and 80.3% respectively. These were sampled using stratified random sampling. The registered contractors at the time in group 5 were 375 and group 6 were 1127. These were obtained from the National Council for Construction data base.

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4.0 DISCUSSION OF RESULTS AND FINDINGS

The respondents used in the survey comprised of contractors who had spent less than 3 years (18%), 3-6 years (36 %) and over 6 years (46%). The respondents perceived industry as averagely competitive (16%) and highly completive (84%). The entities have clearly spent some time in the industry and the majority perceived it as highly competitive. This would imply that they would employ some strategies to survive.

4.1 General Management practice

Management organisational structure: A question was asked if small-scale contracting firms have any management organisational structure that they follow in the firm. The results revealed that 63% have a management structure while 37 percent do not. The reporting system of the 63% is such that only 39% of these have a reporting system which is reporting directly to the director without or without any intermediates or assistants and of the 39 % only 24% have intermediates who report to the director. The intermediary reporting system has an advantage over the direct reporting system in that it gives the director less tasks. Currently director of these entities can be said to have more task and the small scale contractors need to have an organizational structure in their firms.

Entity objectives: The findings reveal that only 51 % (39/76) of the contracts have objects for the entity while 49% (37/76) have no objectives set. This really reviews that small-scale contractors are just running their firms as projects and not as an on-going concern. However, out of the 51% having objectives only a few have somewhat forecasted objectives depicting the future of the firm such equipment earmarked for acquisition or increasing the financial base of the entity. The objectives of the others only focus on the short term operations of a business of having a project, and being able to handle immediate problems.

4.2 Financial Management

Personnel and control: Financial management personnel in the entities include accounts clerks (47% and Cashiers with varying back ground 33% while 20 % of the firms final personnel constitutes of only the owner of the entity.. A person in charge of seeing how finances are flowing is an accountant or accounts clerk. A cashier will only keep records of finance, and also receive and pay out money. It is evident that 53% of the small-scale contractors may have the wrong personnel in charge of finances. In terms of monitoring of fund the director do most of the monitoring and control of fund (89%) and accounts clerk monitoring and control is not substantial (21%). Only a small proportion of small-scale (21%) contractors is doing as required.

Tool for financial management: From the data below, it is clear that a small number of small scale contractors are using the tools for controlling funds. It is however; very saddening that there are contractors (29%) who do not use the tools at all to check how they are doing financially. It could the reason why they do not manage to grow and/or monies are not able to be traced once misused.

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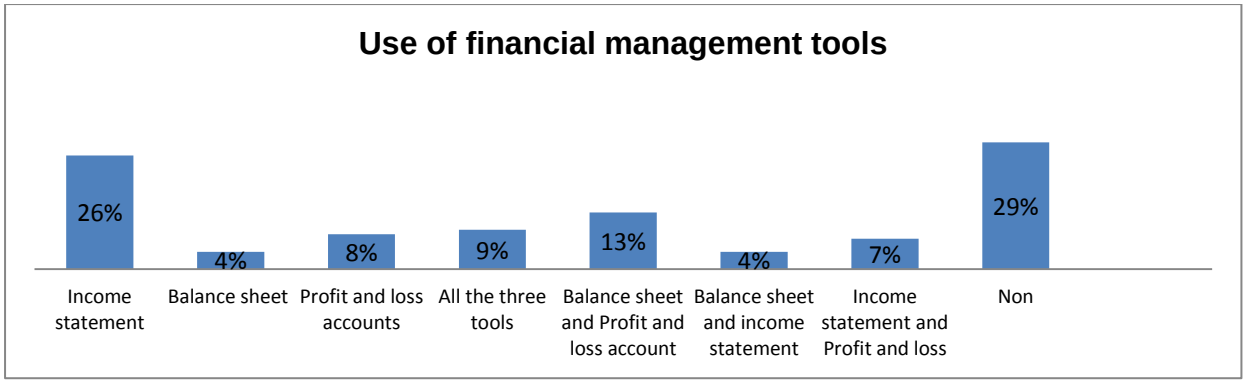

Fig 1.1 Chart showing financial management tools employed by small scale contractors

4.3 Marketing Management

Treatment of competitors: The majority of the small-scale contractors treat their competitors more as rivals (68%) than as benchmarks (32%). This entails that they are not as much willing to learn from their counter parts. Competitors are supposed to be treated as benchmarks: you need to learn from them. Therefore most scale contractors do not stand an advantage in marketing their entity compared to their counter parts.

Competitive strategy employed: Low costing (47%), product differentiation (26%), and focus (21%) are strategies employed yet 5% do not use any strategy at all. From the findings, the strategy with so much preference is the low cost strategy with. This in a way explains why most small contractors make losses on most projects and mostly fail to complete works. This is because they are so desperate for jobs that the only way to get a job is by under-pricing and in the end fail to balance up. Much as it is important to get a job, still there is needed to assess the efficiency of the strategy to be used.

Means of Advertisement: The sampled entities only make use newspapers (20%) and posters (25%) to advertise representing less than 50%. This shows that the majority do not market themselves at all .The entities attributed this to lack of finance and no need to do so .The majority of the small-scale contractors need to embrace the culture of advertising. This is actually how to easily sell the company to the public about the services and/or products offered, and where you are found.

4.4 Production and Operational Management

Time, Cost, quality and profitability

The efficiency of production and operational management can be measured by completion of projects within time, cost and quality. The findings reveal that quite often 58% of the respondents have incurred cost due to time and cost overrun, while very often had a response rate of 4% and 37% have never incurred cost due to time and cost overruns. .The margin for those that have borne costs is higher, this indicates that the majority of the small scale contractors do not complete works on time and have cost overruns. This has led to their businesses making losses and difficult to survive.

Quality is another import aspect in production and operations management. The findings reveal that only (41%) of the small-scale contractors have strategies in place to execute works. The systems include quality assurance plan checklist, and ISO 9001-2008 (Quality Management system). The majority (59%) do not any systems to ensure that quality is attained.

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Profitability is yet another dimension dud to measure effectiveness of production and operational management. From the findings the majority (62) of the firms had incurred losses while only 38% were perceived to have incurred a profit. This was attributed to inability to complete works on time However, there were cases were the client does not supply materials to the contractor, and the contractor has had to provide materials and is never paid. In addition delays in material availability and inflation of prices were other factors noted.

4.5 Public Relations Management

Bad debts written off: The results indicate that 63% of firms had their bad debts written off while 37% showed that they had not had their bad debt written off. This indicates that the majority of the small-scale have a bad reputation in terms of credit worthiness and as a consequence may continue to face financial challenges and lose jobs.

Donations*:* The findings revealed that 43% actually do to various needy organisations while 57% percentages do not. It is desirable for every company to actually donate to society; as this helps to build its public record.

4.6 Human Resource Management

Mode of Recruitment: The findings reveal that 54% of the contractors recruit based on experience, 30% based on and 16 based on tests. Employing based on experience without interviews or a test can lead to employing inappropriately as it is not uncommon for a person seeking employment to claim to have skills they do not have.

Assessment of Performance of employees: Performance of employees is important to ensure that employees are productive. It is also imperative that the right person does the assessment. The study reviewed that most of the time (53%) the owner of the entity does the appraisal ,it is done by a human resource person 32% of the time and other times (16) by other personnel other than a human resource person or the owner. Given the foregoing it is highly likely that the appraisal is subjective of the sometimes as the right person to adequately do the appraisal should a human resource person in consultation with the immediate supervisor.

Skills enhancement: Training is an integral part of human resource development**.** A question was asked as to whether they conduct training for employees for skill enhancement. It is however saddening to note that the majority (62%) of small scale entities in the construction industry do not conduct any training for their employees while a few does (38%). This could be the reason for the poor quality of work produced and time overruns faced by the entities.

Motivation: motivation is key to ensure workers are satisfied. Various method of motivation is employed to motivate workers. The bonus (33%) type of motivation is used, some firms give incentives (14%) while the majority (53%) of the firms to do offer any form of motivation. Motivation among these entities is less than average and could be the reason for poor production and as a consequence projects may not be completed on time and exceed budget.

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Table 1.10 Summary of Utility of Business Management Practices

Business Management Principles	Good	Fair	Poor	Very poor
General Management			√	
Marketing Management		√		
Financial Management			√	
Production and Operational Management			√	
Human Resource Management				√
Public Relations Management			√	

Clearly from the results obtained business management practice amongst small scale contractors in the Zambian Construction industry is generally poor. Marketing management can be described as fair while human resource management is very poor.

5.0 CONCLUSION

Business management principles can be used as a survival strategy in any business environment construction included. The application of business management principles in the Zambia construction industry is generally poor and could be the reason why most of the small scale entities do not survive the industry. These entities account for over 70% of the number of contractors and it can be said that there is high competition amongst them hence the need to employ the principles especially in human resource management which was found to be very poor. It is therefore recommended that the principles be adopted to enhance chances of survival in the industry.

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INTEGRATED INFRASTRUCTURE DEVELOPMENT- LINKING NATIONAL DEVELOPMENTS TO REGIONAL STRATEGIES FOR INFRASTRUCTURE DEVELOPMENT IN AFRICA

Graham Ching'ambu[1]

Abstract

Africa is a continent known to have abundant natural resources. In fact it is estimated that Africa has 10 percent of the world's known reserve of oil; 40 percent of its gold and 80 to 90 percent of the world's chromium and platinum metal to name but a few of its resource wealth.

Ideally this should imply an industrialized continent with well-developed infrastructure. Unfortunately, Africa's industrial and infrastructure development are decades away from reaching the desired levels that fully utilize its potential and assert its global position as a developed continent. The reality is Africa exports most of its natural resources outside Africa in raw form because it lacks the infrastructure to process them into high end finished products and trade these within its own boundaries.

As the current COMESA secretary General (Sindiso Ngwenya) stated *"it is the beneficiation and value addition of the mineral deposits and other commodities that holds the potential for the growth of industrial clusters in Africa…to create Jobs, regional markets, and equitable wealth" (COMESA News Volume I 2014).*

To do so certainly requires developing the right infrastructure that interweaves the continent into regional markets! This encompasses all infrastructure i.e. roads, railways, electricity generation and distribution infrastructure, ports, water ways, water and sanitation, Information and Communication Infrastructure.

This paper seeks to promote an integrated approach to developing infrastructure in Africa. It highlights some of the impact that the current state of infrastructure is having on African economic growth.

It also discusses in brief some of the challenges, in particular relating to the apparent disparity between developments that are on-going at a national level and strategies being forged at regional level. It further discusses some approaches which if implemented would; enhance regional integration by ensuring that the national infrastructure is planned with a regional perspective and harmonized to the regional infrastructure priorities, enhance prioritization of infrastructure that provides regional links in the national planning and promote concerted multi-national mobilization of resources for such infrastructure.

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It is evident that the private sector needs to have a more active role to ensure sustainable development of infrastructure.

Keywords: Infrastructure, Integration, Regional, Intra-Africa

1.0 INTRODUCTION

1.1 Impact of Current Infrastructure Status in Africa

The World Bank has estimated that each year for the next 10 to 15 years, Africa needs $93billion to cover the funding gap for infrastructure. *This represents a huge deficit that requires the concerted efforts of all African countries structured in such a way that priority is set on the development of infrastructure which creates economic and financial capacity to allow for continued investment in infrastructure*.

Africa's road infrastructure development is quite low in quantity, quality and access. Under 20 percent of roads are currently paved, and a study by the World Bank found that a significant share of the road networks built in the 1970s and 80s were in poor condition due to lack of maintenance.

Poor infrastructure contributes significantly to the cost of trade e.g. it is estimated that poor roads increase transport cost by as high as 40% for coastal countries and 60% for landlocked countries (AfDB 2011)

Africa's electrification rate is estimated at 42%, with coverage of 69% and 25% for urban and rural areas, respectively (IEA 2011).

A World Bank study found that the poor state of electricity, water, port, road, rail and communications infrastructure reduced economic growth by 0.2% a year, and cut productivity by as much as 40%.

Table 1: Highlight of the Impact of Status of Infrastructure in Africa

Description	Impact on Cost of Trade (Export Value)	Impact on Productivity	Impact on GPD Growth Per Year
Percentage	↑ 7.7%	↓ 40%	↓ 0.2%
Monetary Value(per year)	$46.6 billion	$ 680million	$3.4 billion
Notes	This relates to freight costs (Transport & Insurance). The world average is 3.7%. This is based on 2011 exports value.	This only accounts for manufacturing which in 2011 was 10% of GDP	This is based on 2011 GDP

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2.0 Appreciating Our Regional Context

With a population of 1.1 billion from 55 countries, Africa has at least eight (8) trade blocs in the form of Economic communities (with some of these overlapping in terms of member state) anchored by regional organisations that unite in the African Union. Sixteen of these are landlocked (land-linked) countries and depending on how the transcontinental countries between Asia and Europe are regard, this is the continent with the most landlocked (land-linked) countries. These countries primarily rely on their neighbouring countries for any regional and global trade.

While regional integration is a well-spoken of phenomena in regional organisations, its actualization is hampered by several constraints chief among them being the lack of adequate infrastructure to facilitate trade.

There is also a disparity between the prioritized national developments and the regional agenda. Whether it is the slow assimilation of regional strategies by countries or the lack of active involvement of the member states in the development of the strategies; one thing is clear a solid link needs to be forged that ensures correlation between the national developments and the regional strategies especially in view of the huge amount of finances needed for infrastructure development on the continent! *We cannot afford to spread our resources too thinly, because that certainly will have no significant impact.*

3.0 Seeing the Opportunity in the Current Challenges

The current needs and challenges in infrastructure present an opportunity for growth if rightly approached. This opportunity can be more fully utilized if proper synergy between African countries is realized.

3.1 Leveraging Our Regional Economic Communities

3.1.1 The power of volumes- the economics of investment

Africa provides a ready market of 1.1billion people. Therefore, theoretically if one's investment could be spread to reach all of Africa, the return on such an investment would be very lucrative.

The return on investment is certainly better for infrastructure that is providing regional linkages. For example, in the transport sector, a road that connects the East to the South within a Country may provide good economic return. But if that road also connects Eastern Africa to Southern Africa then its value in terms of return on investment includes a percentage of the value of the trade happening between the two regions.

The benefits of prioritizing investments in such infrastructure within the boundaries of each nation accrue to the Country as much as to the region. In this regard, we should be in a hurry to actualize the policy frameworks that will enable us to prioritize our infrastructure investments in order to trade easily within regions and the continent at large.

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3.1.2 Connecting Regional Markets to promote Intra African Trade

United Nations Conference on Trade and Development (UNCTAD) reports that in the period 2007 to 2011 intra-African trade only accounted for 11% of the total trade. In contrast for Asia, the figure was 50% (UNTCAD, 2013). This is clear indication that we are not utilizing the trade opportunity.

One of the major draw backs is the inadequacy of trade related infrastructure. Yet when analysed from a regional perspective, the economics of the investments are always better. African member countries need to deliberately focus on infrastructure that strongly supports their ability to trade with other African markets.

Off course, this has be done under the auspice of regional integration to ensure a 'corridor wide' prioritization otherwise an investment made in one country will not be supported by a similar investment in the neighbouring country creating a scenario of missing links, which is unfortunately part of the current challenge.

3.1.3 Thinking Industrial Clusters

Infrastructure void of any industrial activity will only add social benefits. As important as these are, the key aspiration is that infrastructure fosters trade which enables growth. As such they must also be a deliberate focus on industrial oriented infrastructure that enhances production and ultimately trade.

The challenge is how do we enhance our value addition capacity to the abundant natural resources we are endowed with? Such productivity will inevitability boost intra-African trade as each region brings to the market 'a produce from its natural wealth'.

The private sector will most certainly be pivotal in this respect. This demands the need for bankable projects that will demonstrate good financial returns as well further socio-economic benefits.

Perhaps it's safe to say that here the private sector must take the lead and governments should ensure that they provide the framework, policy environment and prioritized public investments that guarantee their success.

Imagine if we could grow intra-African trade by 4% per annum for the next 10 years? Imagine further that 50% of that trade constitutes goods that are wholly produced in Africa processed to high end consumer level? Industrialization and trade have been at the heart of the successful development of any civilization and we need to drastically boost this for Africa.

4.0 Structuring our Development Coordination

Several initiatives have been launched in seeking to achieve a structured way of developing infrastructure. One continent initiative launched by the African Union is the programme for

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infrastructure development in Africa (PIDA) which emphasizes local ownership and is forward looking i.e. from 2010 to 2040. This seems to consolidate into one the various initiatives on infrastructure such as the short-term action plan of the New Partnership for Africa's Development (NEPAD), the NEPAD medium and long-term strategic framework, and the African Union infrastructure master plan.

According to UNCTAD (2013) " If implemented as planned, it is expected to reduce the cost of electricity by $30 billion per year, increase access to power from 39 per cent of the population in 2009 to 70 per cent in 2040, yield efficiency gains of $172 billion from reduced transport costs over 30 years, ensure water and food security and result in a gain of 20 percentage points in broadband connectivity. The short and medium-term infrastructure development projects (priority action plan) covering the period from 2012 to 2020 is expected to cost $68 billion, while the total cost of implementation is $360 billion"

It is further noted that ". Energy and transport projects account for 95 per cent of the estimated cost, reflecting the widely held view that problems in these two sectors are key obstacles to expanding intra-African trade." (UNCTAD 2013)

Therefore, it is imperative that a solid strategy for implementation is structured. Some of the aspects to be considered in so doing include the following;

4.1 Let the Technocrats Speak

One of the challenges of our infrastructure developments is that they are intertwined with politics. This is worsened by the fact that they are very few forums in which technocrats from various nations coordinate to develop and implement regional projects.

Imagine the amount of progress that would have been made if for instance for a regional project such as the north-south corridor which is intended to be a multi-infrastructure (i.e. transport, energy, ICT) corridor the various local authorities of the affected countries prioritized this in their investment plans and coordinated this through a kind of North-South-Corridor Agency?

4.2 Getting the political Buy-in

The influence of politics cannot be understated. In Africa, political buy in is critical to development. But this would be a lot easier to get when the technocrats that advise and 'sell' projects to the politicians are themselves synchronised in their priorities. Even from a political perspective the value of prioritizing infrastructure that enhances productivity and regional trade is an easy sell. Obviously they will always be other developments that are national political priorities but have little value from a regional perspective. The challenge is to ensure that it is these that have to be accommodated among the real economic priorities (that also offer political value) and not vice versa.

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4.3 Focusing our skills on Developing Bankable Projects

One of the challenges that's been noted particularly by the international community is the lack of adequately developed projects to a Bankable level. In fact there is an apparent lack of capacity in this area. This is simply because there has not been a deliberate effort to focus the private and public sector professional skills on developing bankable projects.

We have several projects that have been highlighted as key projects for Africa's regional infrastructure development but the bulk of these are not at a 'ready for financing' stage.

4.4 Built by Africa

The bulk of African infrastructure is built by non-African Engineers and Contractors. While in the global market that we live in they will always be international competition, deliberate strategies to foster African companies must nonetheless be made. According to UNCTAD (2013), "Firm size in Africa is highly skewed towards micro- and small-scale enterprises. While some large firms exist on the continent, medium-scale enterprises that play a crucial role in the economic development of emerging and developed economies are either absent or few in number. The relatively small size of African firms is a source of concern because it means they do not operate at an optimum scale and so cannot benefit from the economies of scale needed to be competitive".

At the same time, the challenge is to African firms to grow themselves to a point of being internationally competitive. Often, this will take no more than a 'joining of hands' of the African firms to strengthen their profile and compete. And this need not be a merger, a joint venture will suffice. *We must continuously recognize that the responsibility and duty to build Africa lies with not with the international community but with Africa.*

5.0 Leveraging International Aid

5.1 Pointing to the Same Priorities

Most African countries continue to receive international aid for development towards infrastructure. The dynamics of this aid are continuously evolving and currently seem to be skewed towards a mix of loans and grants. It is therefore important that this aid is leveraged to finance projects that are regional in nature in order to drive maximum value from the financing from the perspective of return on investment.

There is a further opportunity to combine financing provided directly to African member states and those provided through Regional organisations to focus on regional projects. For instance in the road transport sector out of a total road network of 2,229,160km only 54,120km represent Trans-African Highways(TAH). Of this, approximately 21% (11,365.20km) are missing links to complete the intra-African connectivity. This represents approximately $8 billion worth of investment needed (using some of the current rates of road construction costs).

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This is not too hard to achieve if viewed in the light of the fact that the disbursement of Official Development Finance (ODF) reported by the Organisation for Economic Co-operation and Development (OECD) for 2010 towards Africa was $10.6billion.About 39% i.e. $4.13billion was towards transport infrastructure.

It should be noted that this does not include all the financing in infrastructure as some of the financing such Non-concessional bilateral funds or financing from emerging markets such as China are not included in the OECD report (OECD, 2012).

Table 2: Regional Classification of Missing Links in Trans African Highways (TAH)

Region	Region Total TAH network	Per cent of missing	Km of Missing Links
Northern Africa	13,292	1%	133
Eastern Africa	9,932	17%	1,688
Southern Africa	7,988	15%	1,198
Central Africa	11,246	65%	7,310
Western Africa	11,662	9%	1,050
TOTAL	**54,120**		**11,379**

Source: AfDB

5.2 Regionalizing Private Sector Involvement

With an estimated funding deficit of about $48 billion per year for infrastructure, the role of the private sector has never been more critical in infrastructure development. *Mobilizing such resources will require a lot of innovation and creativity.*

Further, in order to ensure sustainability of the infrastructure investments being made, it is important that the private sector is highly involved. This is already evident in such areas such as telecommunications where the lead by the private sector is enabling a much quicker spread of telecommunications and has built it into a very profitable and sustainable sector. Similar strides need to be made much quicker in areas such as Energy and Transportation.

The scope to pool private sector investment on a regional and ultimately continental basis is there. Projects such as the Power Interconnectors (Zambia-Tanzania-Kenya, Zimbabwe-Zambia- Botswana- Namibia, etc.) most of which have been discussed for over 10 years with little traction further highlight the need for private sector involvement in order to drive them forward.

There is a present opportunity for African companies to grow into strong Global brands built on the backbone of continental and/or regional synergies and markets.

One of the challenges in this area is for governments to have a supportive policy framework. To achieve this requires a proactive private sector that engages governments. This obviously implies that there is need to ensure a level of consistence among countries. Again, the existing regional organisations play an important role in that regard.

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Further, the private public partnerships need to be more strengthened in order to facilitate investments in such public infrastructure that has great economic benefits to the private sector.

It is also critical that the private sector begin to strengthen their ties across countries to achieve the right capacity that enables them to trade across regional markets.

6.0 Conclusion

Developing Africa's infrastructure is not an impossible task. It is well within our reach. The capacity to do so exists, albeit in a fragmented way. If the implementation is well-co-ordinated and integrated from a multi-national, regional and continental level we can very easily accelerate Africa's infrastructure development. This is critical to achieving and integrated Africa.

While political buy in is critical and is to a large extent already existing at a continental level this agenda has to be driven by the technocrats. The private sector must step outside their business as usual agenda and take advantage of the growth potential that developing infrastructure offers. Governments must also be willing to somewhat 'hedge' the risks of the private sector buy among others ensuring the right policy frameworks.

It is evident that the impact of the amount of finances currently going towards infrastructure on the continent, especially at national level would be far much better if prioritized towards developments that increase regional productive capacity and trade.

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MIXED INCOME HOUSING DEVELOPMENT AND NEIGHBOURHOOD REVITILISATION: A CASE STUDY OF COSMO CITY

Onatu, G.[1] and Thwala, W. D.[2]

Abstract

The goal of this paper is to investigate mixed-income housing development as a new approach to integrated human settlement development and planning with the objective to linking it with neighbourhood socio-spatial integration and development. Although the term 'mixed-income housing' development is becoming widely used, there remains certain gap and many open questions about how best to implement it, what are the expected outcomes and can it improve the quality of life and prospects of low-income families? Despite the importance and popularity of the concept of mixed-income housing in national housing policy circles to date very few studies have attempted to evaluate the conditions under which programs have succeeded or failed and the implication for future programs. This calls for an investigation. The goal of the research is to contribute to the debate and add to existing knowledge about mixed-income housing development that is geared towards sustainable development and effective infrastructural development strategies for the poor. The study is a case study based on two South African Cities metros Johannesburg and Tshwane. The investigation is based on contemporary phenomenon with some real life context (Yin, 1994:1). This investigation will be based on an exploratory research and will reviewing the success and challenges of mixed income housing development. Both published and unpublished literatures were equally used in this study as well as focus group discussion and interview. This investigation found out that the mixed income housing development can lead to inclusive city and sustainable development with varying housing typology that meets the needs of cross section of the society. Poverty and social-segregation can be addressed through carefully planned human settlement development strategies. The mixed income housing development to be successful and sustainable there is need for cooperation between the public and private sector. Integration along social, economic and racial line can be achieved through appropriate housing typology.

Key words: Mixed income housing strategy, integrated human settlement, Public, Private Partnership and Poverty alleviation.

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1.0 Introduction

The inadequate supply of affordable housing for low-income families and the increasing spatial segregation of some households by income, race, ethnicity, or social class into unsafe neighborhoods are among the most prevalent characteristics of South African urban space. When affordable housing is not available to low-income households, family resources needed for food, medical or dental care and other necessities are diverted to housing costs (Anderson, et. Al, 2003:47). Mixed-income housing development has been variously defined. According to (Smit & Purchase, 2006:1) “mixed-income housing” refers to developments that combine market-rate and public assisted units, for people with income levels ranging from above-moderate income to very low. “Inclusionary housing” requires that a certain percentage of new residential development be set-aside for the occupancy by families of very low and moderate-income levels. “Inclusionary zoning” is when mandatory inclusionary requirements are incorporated in the zoning code or housing element of a municipality and obtaining building plans is made contingents on the developer’s agreement to provide affordable housing. For the purpose of this paper I shall use the term “Mixed-income housing” to represent any or all the types of initiatives defined above. This is because the literature rarely differentiates between these initiatives. At the affordable housing Indaba in 2012, mixed income housing is described as one of the government approaches “to promote mixed-tenure, mixed land use development that will integrate, de-racialize and restructure urban space. It is also intended to maximize available land use and encourage effective use of well-located land and with the objective to ensuring that housing development in South Africa responds to the political intentions of government in creating diverse, viable and sustainable communities” (GPF, 2012).

Various studies have been conducted on mixed income housing development in the past (Department of Housing South Africa, 2005; Duda, 2005; Hoek-Smit, 2002; Huchzermeyer, 2005; Marshall, 2005; Milligan, et. Al, 2004; Smit et.al, 2006;). These scholars point out that mixed-income housing development is an innovative approach to housing delivery that provides a mixture of housing products to suit low income earners, middle income earners as well as high income earners. Proponents of mixed-income housing at another angle posit that economic diversity within a neighbourhood would automatically enhance community interaction and improve neighbourhood characteristics (Cole & Goodchild, 2001; Joseph, 2006; Kleinhans, 2004). Early studies on mixed-income housing initiatives were guided by the general hypothesis that enhanced neighbourhood conditions-physical, political, and

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socioeconomic-translate into public goods that were broadly distributed across all households (Fraser & Nelson, 2008). Studies has shown that mixed-income housing does not automatically produce these hypothesized neighbourhood-and household-level outcomes and also in the U S (Kleit, 2001 and Salama, 1999).

Joseph, Chaskin, and Webber, (2007:2) further describe mixed-income housing development as an urban redevelopment strategy. They noted that as far back as 1990s, mixed-income housing development has gained increasing attention from policymakers and local developers, particularly as a tool for the transformation of failed public housing developments. According to their findings, mixed-income can lead to behavioural change of the poor and improve social network as well as enhance social control. DeFilippis and Fraser (2008:2) in reaction to these findings question the premises on which mixed-income housing and neighbourhood (MIHN) policy were always based on the above stated reasons as they found themselves attracted to the 'ideal", in theory, but frustrated by its reality in "practice". According to their research, these policies tend to 'leave poor people in places without the social networks and informal social support of prior neighbourhood' (ibid: 10). Poor urban neighbourhood is noted to have dense networks of social support that have been created out of necessities because services that are commodities in wealthy neighbourhood (childcare, for instance) must be negotiated as non-commodified when the participants do not have money. They noted that mixed-income policies have failed to create social mixing, networks, interaction as well as institutional services and capacities. Being in close proximity need not engender interaction, and when it does, that interaction may mean conflict as much as anything else.

Rosenbaum, Stroh, and Flynn (1996) provide the most in-depth study to date of a mixed-income housing development-Lake Parc Place in Chicago. According to Schwartz & Tajbakhsh (1997) these scholars found out that in terms of general viability the project had succeeded in attracting moderate-income working households and that after several years in operation it is considered safe and without serious management difficulties (Rosenbaum, et al, 1996). They found out that for the less-demanding form of interaction (such as greeting and talking for more than 10 minutes), the project group interacted with neighbors more than did the non-project group, although there was no evidence that the latter isolated themselves from other households. The analysis by Rosenbaum, et al, raises important questions and suggests at least three issues for future research. First their analysis of intergroup activity remains somewhat inconclusive because as they acknowledged, their research did not record with whom residents interacted or with whom they maintained friendship. Secondly, the issue of safety and extension of interaction to friendship among neighbors and lastly, the extent to which residents are satisfied with their houses. In proposing the need and

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objectivity of Inclusionary housing in South Africa Smit (2007:11) recommends that it should be meant for the following objectives:

- To make a contribution towards achieving a better balance of race and class in new residential developments
- To provide accommodation opportunities for low income and lower middle income households in areas from which they might otherwise be excluded because of the dynamics of the land market
- To boost the supply of affordable housing (both for purchase and rental)
- To mobilize private sector delivery capacity to provide affordable housing
- To leverage new housing opportunities and the existing stock that contributes to the densification of South African cities
- To make better use of existing sustainable human settlements infrastructure

Smit (2007) also emphasized the need for local circumstances to be taken into consideration as it relates to existing development use rights as protected by law and the factoring in social infrastructures as used by low income individuals. This paper will appraise the development of mixed income (inclusionary housing) housing in the light of the above objectives and unpack hidden challenges and gap in the approach in relation to South African context.

2.0 The Research Objectives

Although the term 'mixed-income housing development (inclusionary housing)' is becoming widely used, there remains certain gap and many open questions about how best to implement it, what are the expected outcomes and how can it improve the quality of life and prospects of low-income families? Despite the importance and popularity of the concept of mixed-income housing in national housing policy circles, Schwatz & Tajbakhsh (1997) noted that very few studies have attempted to evaluate the conditions under which programs have succeeded or failed and the implication for future programs. This calls for an investigation. This research will also inform urban planning initiatives by trying:

- To evaluate South African Housing Policies/challenges and the context in which mixed-income housing development strategy can be considered in view of this historical background.
- To examine the shift in urban development strategy with a focus on informal settlement upgrade and inclusive city strategies using mixed-income housing typology.
- To recommend how not in my back yard syndrome concern over property value and crime can be overcome if mixed–income housing development strategy is well managed through shared responsibilities and effective communication.

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3.0 Methodology

The study is descriptive in nature and explores the relationship between housing policy and practice using literature review and other secondary data. These findings will be contextualised in Johannesburg and Tshwane as a case study because these two provinces are experiencing high rate of migration and attendant housing shortage. The reason for using case study is because of the need to provide thick description, deep understanding and prediction of outcomes, and control of behaviours exhibited in the specific case (Woodside, 2010:13). The goal of the research is to contribute to the debate and add to existing knowledge about mixed-income housing development that will lead to the provision of sustainable human settlement development for the poor. The use of Johannesburg and Tshwane as case study is because both are the country's economic and administrative centre with attendant high rate of urbanization and housing challenge. The investigation is based on contemporary phenomenon with some real life context (Yin, 1994:1).

4.0 Background to South African housing policy

The cornerstone of the post -1994 housing policy was a new Housing Subsidy Scheme with a once-off capital subsidy target at the 'poorest of the poor' (Tomlinson, 2006: 88). The government housing subsidy is a grant that the government gives to South African citizens or permanent residents who need help to get a house of their own. Beneficiaries are not expected to pay it back, but it is not money in your hand. The money goes to the developer or builder to help you pay for your land or your house. A developer can be a private company, the municipality or a community organization. The housing subsidy scheme is divided into different categories, namely, project-linked subsidies, individual subsidies, consolidated subsidies, institutional subsidies, rural subsidies and people's housing subsidy. Many housing practitioners consider South Africa's housing programme to be one of the most successful of any country in history (Gardener, 2003:7). The publicly stated target was to develop one million subsidized houses within five years. On average 470 housing units were delivered in South Africa every day between May 1994 and May 2002 (Rust, 2003), affecting the lives of over 6 million people. According to one analyst, nowhere in the developing world have countries committed such vast resources to providing free or subsidized houses for the poor like South Africa (Sunday Times, 2007:20). The comprehensive housing programme, "Breaking New Ground", also confirm government commitment in this regard with key objectives:

1) *Accelerating housing delivery*

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2) *Improve the quality of housing products and environment to ensure asset creation*
3) *Ensure a single, efficient formal housing market*
4) *Restructure and integrate human settlements.*

While the above comprehensive housing programme notes the continued relevance of the state housing programme introduced in 1994, it flags the need to redirect and enhance various aspects of policy, and commits the Department of Human Settlements to meeting a range of specific objectives which is basically the creation of sustainable human settlement (DoH, 2005: 4).

5.0 CASE STUDY 1

5.1 MIXED INCOME HOUSING DEVELOPMENT: IN COSMO CITY, JOHANNESBURG

Cosmo City emerged out of an urgent need to provide accommodation for the informal settlers of Zevenfontein and Riverbend who had been illegally occupying privately owned land 25km North West of the Johannesburg CBD. These informal settlements were characterized by substandard living conditions with limited access to basic services (Cowden, 2006). The socio-economic profile of both communities is based on low income levels, high unemployment rates and low educational levels amongst other breadline issues (Christiana, 2009). The idea was that Cosmo City would create jobs and stimulate local economic activity for these people. It is located north of R512 road and falls under Peri-Urban Land Use Zoning. The choice of the location for mixed-income housing project has been found to be of central important for economic viability. Finkel et al. (2000) noted that if a site is convenient and attractive, higher-income residents will be drawn to the newly built residence, especially if there is availability homeownership. Cosmo City is very accessible and well located. It is a Greenfields development commissioned by the City of Johannesburg in conjunction with the Gauteng Provincial Housing Department (Cowden, 2006: 1). The project was conceptualized to stand out as a mixed-income residential development where people of different income groups live in the same area utilizing similar amenities. The projects have been driven with so many difficulties, especially from surrounding neighbours who waged series of legal battle that the development will devalue their properties (www.worldbank.org/southafrica). The delay in this project also centres on NIMBY syndrome which plagues spatial distribution of human settlement throughout South Africa (Luc Limacher, 2009). The project was announced in 1997 but only commenced in 2005. Cosmo City tends to demonstrate that the supply led approach to housing delivery can be as slow as compared to demand-led approach.

The objectives of the development are:

- To be the first green-field developments that will endeavour to comply with integration and sustainability principles as per government policies and legislation
- To assist in meeting the pressing demand for housing in the north-western part of the City of Johannesburg resolving the conflict between environmental consideration, economic consideration and social responsibility

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- To make a statement towards integration along racial and social grounds and negative perceptions that exists around such integration
- To make a political inroad in the access of the poor to formal urban system

5.1.1 Private Public Partnership

The project is a private public partnership between the City of Johannesburg (the land owner), the provincial government (the subsidy providers) and Codevco (a private entity formed between Basil Reed and Kopano Kematla. CODEVCO (Pty) Ltd was the appointed main developer for the project. The developers' vision of the Cosmo City is not only to provide affordable housing but to provide the community that lives there with socially conducive environment including facilities such as commercial precinct, city square, open spaces and sense of belonging (Chritiana, 2013).

5.1.2 Project Description and Planning

The project is located on 1100 hectares of land with vast wetland and Zandspruit River cutting through the site. Work started on-site on January 2005 and due to the vast size the project was divided into phases. It comprises of:

- 5000 – Low income houses (income group R0-R3, 500.00) each unit is 36m2 of floor space and consists of 2 separate bedrooms, bathroom space with a flush toilet and a living area. These are known as RDP houses.
- 3000 – Financed credit linked houses (income group R3, 501 –R9, 670) Subsidies are provided for people earning up to R7000.00. First National Bank (FNB) is a partner to this section of the project providing 'step up' loans and the Department of Housing will provide the subsidy. According to Luc Limacher (2009) "banking institution never wanted to touch the idea at the initial stage but now they are lining up wanting to get involved". The house type ranges from 45m2, 50m2, 60m2 and
- 65m2 with price range from R184, 000.00 – R244, 000.00. Beneficiaries are expected to make some deposit and subsequently pay monthly instalment. They comprises of two bedrooms, a bathroom, kitchen, lounge and a patio.
- 1000 – social housing rental units (income group R1, 500 – R9, 670)
- 3, 300 – bonded houses (open market)
- 12 – Schools
- 40- sites for churches, clinics and crèches
- 43 – parks and recreational sites
- 30- commercial and retail centre
- 40ha – industrial park

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- 300ha – environmental areas

5.1.3 Social Amenities

All the development has ample space for parking on site. 5% of the subsidies allocated to this project is reserved for disabled and 5% for right sizing (Zack et al, 2005). Three schools have been completed; two primary schools and one high school and both have been handed over to the Department of Education. Brophy and Smith (1997) find that the provision of attractive, onsite amenities and services will assist in drawing a critical mass of upper-income residents. One amenity that researchers find as a pre-requisite for drawing upper-income residents with children to mixed-income developments is access to safe and high-quality schools (Varady et al. 2005). Three parks were funded by the Johannesburg City Parks and are equipped with various amenities, such as basketball court and cricket net. An informal trading area is provided in the vicinity of the low-income areas to allow them to continue with income generating activities. There is site for the establishment of churches and a catholic church is already up and functioning in Extension 0. It does not have a functional police station but presently uses the service of nearby Honeydew Police Station.

5.1.4 Management

The City of Johannesburg is the owner of the project and has appointed Codevco for the overall management of the project. It is anticipated that as soon as the entire project is completed there will be numerous management structures, especially the bonded houses and social housing units. There are 23 municipal entities on site to see to utilities services and maintenance. Good management of the differing needs of income-diverse residents (Varady, et al. 2005), as well as the challenges associated with effective coordination between public and private sectors, is seen as essential to mixed-income success. Wexler (2001) confirm this in his study by noting that this often requires the public housing authorities involved in this type of development build the capacity to ‘use private market forces to achieve public ends’. To oversee the concern of the communities a Resident Association is being established in each extension with a leader. A monthly newsletter, Cosmo City News was initiated by Codevco to keep people informed about what is happening around them. This is distributed around the community. It includes news about crime, public meetings, the latest development in the area and entertainment. Complementing the newsletter is a website where residents can post their concern and comments on any issue.

5.1.5Challenges

When the project was designed they had not anticipated so much demand to require big chain stores. There is also the problem of informal trading, spaza shops and illegal land uses. These businesses do not comply with Town Planning Scheme and related by-laws. This poses a lot of challenge to the City council as the proliferation of this if not controlled

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might result to slum and impact on the sustainability of the project. The series of budgetary cut witnessed by the project is also of major concern to the project team.

6.0 CASE STUDY 2

Home at last (Ekugcineni ekhaya) Olievenhoutbosch's a new flagship housing development well under way after years in planning. This is one of the development contracts that were signed between the City of Tshwane and Absa (UGF, 2008). It caters for a mix of classes and uses on what was previously undeveloped, Absa owned land. This development is mixed –income housing development in that it intersperses houses for the affordable market (bonded) with those in the subsidy, social housing and rental markets – a mixed-income, mixed used development. It is not, though, officially an inclusionary housing project as government's policy in this regard is yet to be legislated. According to the policy a developer would forego potential income by including affordable houses in centrally located projects. The local authority, in turn, would provide a subsidy to make good for the developers diminished profits. Coined as a sustainable inclusionary development (SID), Olievenhoutbosch, represents a departure from housing systems where affordable and market related housing are treated as separate processes and products; segregating urban citizens on the basis of income (UGF, 2008).

This is a flagship joint agreement project between the national, provincial and local departments of housing, the City of Tshwane Metropolitan Municipality and Absa. Since 2004, Absa has been acting as Landowner and developer (through Absa DevCo) for the City of Tshwane (UGF, 2008). According to Absa DevCo, the project "provides integrated, mixed housing solutions, as well as sites for education, business, public open space, sport and other facilities- a mix required to establish a quality live-work-play environment and which promotes a sustainable society". The R450-million Project budget (including top structures) is being spent over three years with funding derived predominantly from provincial subsidies. City of Tshwane top-up funds and Absa Devco's private investment (UGF, 2008). Absa has set put bridging finance for bulk service costs while it awaits approval for Municipal Infrastructure Grant and municipal funding. According to Mala Harrilal from the Department of Housing at the City of Tshwane, top-up funding has been provided by the municipality for the installation of services and water meters.

6.1 Design informed by mixed use and open space

In terms of its layout, Olievenhoutbosch recognises the need for mixed use within the development. Land is provided for schools, clinics, sports facilities, churches, small-business opportunity nodes, retail, taxi drop-off zones, as well as a taxi rank, community centre, community markets and a central landmark site (public open space) to provide a sense of place(UGF, 2008). It is envisioned that light-industrial use will be located along the busy Waterberg Road; attracting small-scale manufacturing. The design rationale follows various underlying principle, such as making connections, balancing movement ensuring local district networks based on "walkable" distances, design for safety and security, a mix of building typologies, investment in the public realm, and allowing for a broad mix of uses.

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Prominent in the design is its legibility and Connection to surrounding land uses (UGF, 2008).

This policy is concerned with "the harnessing of private initiative to include affordable housing opportunities in order to achieve a better socio-economic balance in residential development as well as contributing to an increase in the supply of affordable housing.

According to town planner Andre Kotze, design elements that have shaped Olievenhoutbosch's structure include:

- A semi-circle of public open space at the core of the development around which everything else "fits". It creates opportunity for symbolism and could be developed into a ceremonial public space.
- Boulevards radiate from this central space, intersected by a ring road, which serves to connect and link the site with developments to the south
- Boulevards act as activity spines linking different residential areas while providing vistas from the centre of the site to the edges- Intersections create opportunities for activity nodes within which land is zoned for higher-density residential, retail and commercial use, as well as churches, crèches and clinics.
- Activity nodes are visible from the central open space, acting as landmarks, which, together with the simple road layout, create a degree of legibility on the site as well as a sense of place within a certain scale; encouraging easy movement around the site. Activity spines, a hierarchy of roads, nodes, visible landmarks and difference in housing typologies work together to make Olievenhoutbosch legible.
- Highest-density, three-storey residential walk-ups are located towards the centre while density decreases towards the perimeters. Highest-density land use is closest to public-transport opportunities and community facilities.
- Opportunity for higher density is used at intersections within the bonded areas to form two-storey walk-ups.
- Principles of complementary land use have been applied — schools are located adjacent to public open space; business and light industry are located along busy roads; commercial retail and taxi ranks are located at intersections in close proximity to high-density residential use.
- Unlike many RDP developments where units turn their backs on the streets, all units have been oriented to face streets and public open spaces in the interests of natural surveillance.
- Street lighting is provided on all streets.
- I Public open space has been provided among the residential areas as well as along a natural drainage area; taking into account the 1:100-year flood line.
  Source: (UGF, 2008).

6.2 Better subsidised houses

As opposed to "traditional" RDP housing, the subsidised units include greater levels of specifications and finishes, including tiled roofs, individual orientation, variety through slightly differing design features, reduced site areas (to allow easier and affordable maintenance), interior pre-paid electrical connections, potable water and sanitation (UGF, 2008). The development has fully-tarred roads, a 100% covered storm-water drainage system and electrical services running below ground — all setting the development apart from the usual

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fully-subsidised units. In this way, infrastructure maintenance is dramatically reduced as is the life-cycle cost of the development (UGF, 2008).

6.3 But what about sustainability?

At a time when sustainable development is vital in our urban areas, Olievenhoutbosch has had additional challenges to overcome, most notably in terms of budget and margins. Some green issues have, however, been addressed. The most significant is the planting of indigenous trees along the main roads throughout the development in total, 90 ha of Eucalyptus trees was cleared from the site (about 20 000 trees). A retention pond has been built to the north-east, at the lowest point, to catch external storm water. In time, with correct maintenance, this could become a "natural' wetland" (UGF, 2008). The urban form has the building blocks of sustainable development through increased residential densities as well as mixed use along the southern boundary. Due to improved service levels introduced at construction stage, Olievenhoutbosch should show lower maintenance costs in infrastructure throughout the project's life cycle. The developers have also ensured a level of "ownership" in the development: the project steering committee conducted a significant public-participation process with communities in these areas; taking into account historical political sensitivities in Olievenhoutbosch (UGF, 2008). The community has had input into the Layout and design of the development. Active community involvement in project construction took place during the tender and procurement process with contractors employing local labour for the various phases out services and construction of the top structures (UGF, 2008).

6.4 Holding costs problematic

Absa and the City of Tshwane have faced numerous challenges throughout the development phase. The time taken to roll out the development has resulted in Absa incurring significant holding costs despite the municipality's undertaking to fast-track the process (UGF, 2008). Environmental impact assessment approval processes have been onerous and have hindered progress. Increases in the cost of money and building have rendered the affordable R250 000 units no longer viable. The cheapest units now start at 9300 000 and this increases the "gap" in the affordable market. Absa has experienced significant on-site vandalism of the subsidised units; completed units have been stripped bare of wiring and finishes in the time between unit completion and handover. This is an additional and unexpected cost, which has been absorbed by the bank (UGF, 2008).

6.5 Sense of community already exists

Although still very much in a state of development, Olievenhoutbosch has become "home" to most residents. Private gardens are beginning to spring up within yards, spaza shops are operating tram front rooms and informal traders are scattered around intersections.

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6.6 On-going management required

In terms of management and maintenance of the development, Absa has established an Independent company to manage the rental stock based on precedents, which show stringent management, is necessary to make rental units work. The City of Tshwane ¡s managing the allocation process of subsidised units. Other than this, there seems to be little or no need for management of the development (UGF, 2008). The need for post-development management has been well-documented, many precedents show management inherently linked to sustainability. On site, it is evident water and sewer connections are leaking. Silt has blocked some of the roads. Newly-completed units have been stripped of finishes through theft. Spaza shops end informal traders serving the community are, arguably, necessary in terms of job creation and the informal economy but what effect do they have on the sale of bonded units?

Aside from managing and minimising negative aspects of the development, management could be used in a proactive way to build community, green the area, grow food, start recycling initiatives, become a platform for skills-development programmes and build cooperatives with sustainability as the ultimate aim (UGF, 2008).

6.7 Lessons Learned

Olievenhoutbosch include:

- The need to promote more of a mix between housing typologies in order to avoid repetition and create visual interest in the development; perhaps mix semis with single dwellings per ERF and intersperse walk-ups with freehold units.
- More emphasis on mixed use, especially retail. Larger areas dedicated to retail arid business would also promote a more sustainable urban environment with employment opportunities closer to home.
- Orientation — better orientation as compared to Cosmo City of units to ensure all open spaces are over looked as well as maximising sunlight in the units (as adopted by Absa in Chief Mogale, Krugersdorp).
- Develop and implement an integrated management plan to ensure sustainability of the development and this is meant to guide the problems encountered in Cosmo City.

The structure is certainly there, as a platform for this to take place. Is this just another dormitory town? While the developers and designers of Olievenhoutbosch could have done more to ensure a Pedestrian-friendly environment and to create mixed use within properties rather than limiting use to different property zones, they could, nevertheless be on to a successful housing model. But more focus on green issues and density is still required.

7.0 Conclusion and Recommendations

Integrated community and human settlement can be created and fostered through mixed income strategy. There is need to strengthen the inclusion of mixed income (inclusionary housing) as a policy objective into South African Human Settlement legislations. Mixed income housing has the ability to deal with South African highly segregated built

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environment as access to land is a very big issue and to acquire prime land for the location of the RDP houses is very difficult. The success of Cosmo City stems from the appropriation of land by the City of Johannesburg, the provision of subsidy by the Gauteng Provincial government and the project execution and facilitation by private developer. This synergy invariably brought down the development cost. Whether or not Olievenhoutbosch achieves the socio-economic integration principles as a requirement for sustainable human settlements described in the BNG policy will only become evident once the development is completed and all units have been occupied. Will Olievenhoutbosch combine everyone into a single community, where families from disadvantaged backgrounds are integrated into wealthier circles and exposed to different aspirations and standards of living?

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MARKETING, TENDERING AND ESTIMATING COMPETENCIES OF CONSTRUCTION SMES: A LITERATURE REVIEW

L. Wentzel[1], J.J. Smallwood[2] and F.A. Emuze[3]

Abstract

Marketing, tendering and estimating have generated vigorous debate when deliberating them from a construction small and medium sized enterprise (SME) perspective. This is evident from the many challenges and proposed solutions that have been shared by various authors. However, the business climate in the South African construction industry is ever changing, and demands research, which identifies current marketing, tendering, and estimating challenges and related solutions. This paper is therefore in the form of a literature review with a special focus on improving marketing, tendering and estimating competencies in construction SMEs. The literature search and critique is a precursor for a larger empirical study in the subject area. The findings indicate that marketing, tendering, and estimating is practiced differently by construction SMEs when compared with large established construction firms. The findings inform that there are major pitfalls with regards to marketing, tendering, and estimating competencies within construction SMEs. The findings further show that the pitfalls impact on the development of a model for SME marketing competency development. In addition, introducing and identifying a conceptual framework, which consists of independent and dependent variables could provide insights that would address marketing, tendering and estimating challenges experienced by construction SMEs.

Keywords: Competencies, Construction SMEs, Estimating, Marketing, Tendering, South Africa

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1. Introduction

In the last sixty years, marketing deliberation has experienced several changes. It has evolved from a production and sales centred process to a customer and relationship focused marketing approach. Instead of short-term individual transactions, marketers have started to value long term relationships. Interaction has proven to be more efficient than one-way communication, and it has been realised that marketing is not a task of just the marketing department, but the whole organisation (Reijonen, 2010: 280). According to Kohli and Jaworski (1990) cited by Reijonen (2010: 280), marketing can be seen as a business philosophy, an ideal or policy statement. Several authors cited by Reijonen (2010: 280) were also of the opinion that marketing could be viewed as a culture or organisational philosophy, a strategy, and tactic.

1.1 Marketing in SMEs

According to Resnick *et al.* (2011: 38), marketing theories are typically taught and understood from conventional textbooks, which generally focus on marketing activities such as planning, research and implementation within the marketing mix. These theories are initially designed for large organisations where financial resources and marketing expertise are more readily available. However, SMEs are recognised for their unique and particular characteristics, which affect the way in which they approach marketing (Parry *et al.*, 2012: 713). O'Dwyer *et al.* (2009: 47), postulates that, the resulting lack of formal and conventional marketing concepts within SMEs can be misconstrued as a lack of marketing in some instances, whereas much of the literature pertaining to SME marketing, identifies the presence of a form of marketing which is unique to small firms and which adapt general marketing concepts, practices, and theories to suit their own purpose while maintaining a process-focus on incremental innovations. A study conducted by Scott *et al.* (1996) cited by Parry *et al*. (2012: 713) determined that small business owners are often generalists as opposed to specialists, and thus, complex marketing models that have been developed for large firms may not be appropriate for SMEs.

It could be argued that SMEs pay less attention to marketing as an important function of the business due to the fact that marketing is often perceived as a large organisation activity (Resnick *et al*., 2011: 38). In addition, Krake (2005) cited by Resnick *et al*. (2011: 38) confers that marketing is seen as a "troublesome and problematic undertaking for SMEs." According to Resnick *et al*. (2011: 38), marketing within SMEs takes into consideration the firm's unique business environment, limitations in terms of resources and the characteristics of the owner-manager, such as skills and abilities in terms of decision making. This is illustrated in Figure 1. In addition, Parry *et al*. (2012: 713) suggest that the management culture of SMEs is more innovative and entrepreneurial. This is arguably due to their smaller and flatter structures and absence of bureaucracy, which improves communication, knowledge sharing, and collaboration (Parry *et al*., 2012: 713-714).

Figure 1: Characteristics of SME marketing (Source: O'Dwyer et al., 2009: 48)

O'Dwyer *et al*. (2009: 47) confer that SME marketing practices and decision making tends to be more creative, alternative, instinctive, informal and unstructured, chaotic and unplanned. Resnick *et al*. (2011: 38) also mention that the nature of the SME context and the features of SME owner-managers have a significant impact on how small firms practice marketing. It is argued that SMEs involve themselves with marketing as they engage in activities, such as networking and relationship building (Resnick *et al.*, 2011: 38). However, Resnick *et al.* (2011: 38) are of the opinion that SME owner-managers are inclined to focus on tactical issues rather than strategic issues as they are less concerned with long-term planning for the business. It is in this regard that Moriarty *et al.* (2008) cited by Resnick *et al*. (2011: 38) stipulate that SME owner-managers lack understanding of the definition of marketing and its application. Nevertheless, Van Scheers (2011: 5050) states that marketing remains one of the most important tasks for SMEs in South Africa and is a key determinant of either success or failure of a business.

1.2 Marketing challenges and the competencies needed for effective marketing in SMEs (Construction SMEs)

With regards to the high failure rate of construction SMEs, Van Scheers (2011: 5051) identifies a number of marketing challenges, which are exacerbated by the lack of adequate marketing competencies. These include: the ability to access finance; the ability to understand the market and potential for growth; the ability to conduct a market needs analysis; understanding the concepts of market segmentation; access to education and training; the ability to market products and services, and the ability to compete.

To overcome these marketing challenges, Gilmore (2011: 142) is of the opinion that there are many managerial competencies such as vision, innovation, creativity, lateral thinking, leadership, communication, motivation, intuition, judgement, and knowledge that would prove helpful. However, some of the managerial competencies are more fundamental than others with respect to owner-managers of SMEs and the marketing context. Gilmore (2011: 142), opines that, many owner-managers of SMEs perceive themselves to have limited marketing ability, primarily because of their prior interests and background which brings to the fore their unlikelihood to attribute useful marketing experience and skills to their businesses. Gilmore (2011: 142) in addition mentions that in the early stages of business, many owner-managers of SMEs possess only 'technical' competencies and soon learn that they need to develop overall core business competencies.

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It is in this regard that Reijonen (2009: 29-30) identifies four core competencies that relate to effective marketing in SMEs. These four competencies are knowledge, experience, judgement, and communication. The reason why these attributes are represented as core competencies is that SME owner-managers will often possess some competency in relation to knowledge, experience, communication, and judgement which relates to the industry in which they work (Reijonen, 2009: 29-30). Reijonen (2009: 29-30) further confers that these four attributes should enable SME owner-managers to perform within the context of the industry frameworks and norms, and could also be used as a basis for building more specific competencies as dedicated by the firm or organisation's specific situation.

However, it is the development of these four competencies to achieve experiential learning, **(K+E+C+J=EL)**, which forms the competency base for sound marketing practice in SMEs (Carson and Gilmore, 2000: 368). In other words, Carson and Gilmore (2000: 368) confer that experiential learning is built upon the existence of market knowledge, experience, communication, and judgement of owner-managers of SMEs. Each time period therefore, illustrated in Figure 2 below, represents an experiential learning period in which an SME owner-manager improves his or her competency base, which contributes to the ability of the SME owner-manager to make current marketing decisions during each period.

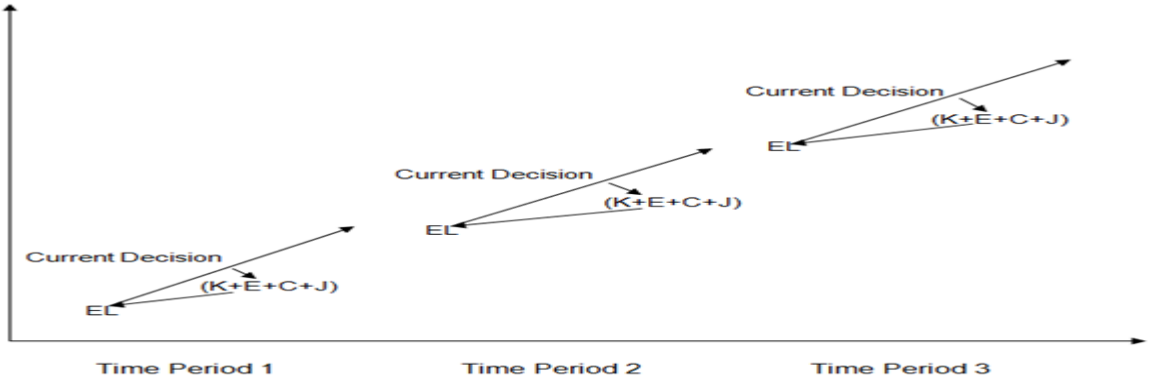

Figure 2: Experiential Learning (Source: Dweyer, 1938 cited by Carson and Gilmore, 2000: 369)

According to the Association to Advance Collegiate Schools of Business Task Force (1986: 3) cited by Gentry (1990: 10), experiential learning is defined as a business curriculum-related endeavour which is interactive (other than between teacher and pupil) and is characterised by variability and uncertainty. Rodgers (1969: 5) cited by Gentry (1990: 10) further defines experiential learning as a quality of a personal involvement-the whole person in both his / her feelings and cognitive aspects being in the learning event. Building on the previous two definitions, Hoover and Whitehead (1975: 25) cited by Gentry (1990: 10) define experiential learning as follows: "experiential learning exists when a personally responsible participant cognitively, affectively, and behaviourally processes knowledge, skills and / or attitudes in a learning situation characterised by a high level of active involvement".

However, in the marketing context, Carson and Gilmore (2000: 368) confer that experiential learning is not formal learning, but learning by experiencing the trials, tribulations, highs and

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lows of the combative and competitive marketing domain. Carson and Gilmore (2000: 368) further mention that it is the ability, degree, and pace at which experiential learning within the marketing domain can be achieved which is crucial to successful marketing in SMEs. To comprehend Figure 2 holistically, it is important to understand what is meant by market: knowledge, experience, communication, and judgement.

1.2.1 Market Knowledge

Lewke and Kelner (2007: 1) state that market knowledge refers to the knowledge: which the owner-manager of an SME has in terms of the market in which the firm exists; of competitors and the threats they represent; of key informants and networks within the market, and of the firm or organisation's strengths and opportunities.

1.2.2 Market Experience

According to Carson and Gilmore (2000: 368), market experience can be described in terms of both 'width' and 'depth'. The depth of market experience refers to the circumstance of working in the same area over a period of time allowing detailed, concentrated involvement and understanding of specific marketing tasks and responsibilities. This will include experience in dealing with market and competitor shifts and changes, experience of product and marketing attributes which work best, and experience based on past mistakes and successes (Carson and Gilmore, 2000: 368). The width of market experience refers to the transferring of experience to other situations, and contributing to the building and development of the firm or organisation's overall performance. Carson and Gilmore (2000: 368) further say that this could be stimulated by taking opportunity to experiment, try out new ideas, learn from experience and having the ability to develop and expand on experience for future endeavours.

1.2.3 Market Communication

Fill and Jamieson (2011: 2-3), market communication refers to knowing which form of communication works best, such as advertising, sales promotions, personal selling, public relations, and direct marketing, where to emphasise, when and which audience to attract, and how to gather information from key sources.

1.2.4 Market Judgement

Carson and Gilmore (2000: 369) are of the opinion that market judgement refers to the ability of an owner-manager of an SME to consolidate all the features of knowledge, experience, and communication in order to judge how best to take a decision and which decision is best suited for specific circumstances.

As mentioned earlier, many owner-managers of SMEs often only possess technical competencies during the early stages of their business experience. With the addition of the four core competencies, namely, knowledge, experience, communication, and judgement, which relate to effective marketing in SMEs, Carson and Gilmore (2000: 370) are of the

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opinion that in any business environment there is an optimal mix between the two, technical competencies and marketing competencies. This mix would be represented by specific circumstances which owner-managers of SMEs would experience. It is with this scenario that Carson and Gilmore (2000: 370) introduce the marketing (decision-making) and technical competency model represented by Figure 3(a); (b); and (c). This model incorporates two axes, the vertical one which plots marketing management decision-making competencies (K+E+C+J) on a continuum ranging from positive to negative competency dimensions, and a horizontal axis which plots the technical competencies on a continuum of positive and negative competency dimensions. The combination of these two axes, allows owner-managers of SMEs to evaluate their profiles of the competencies represented.

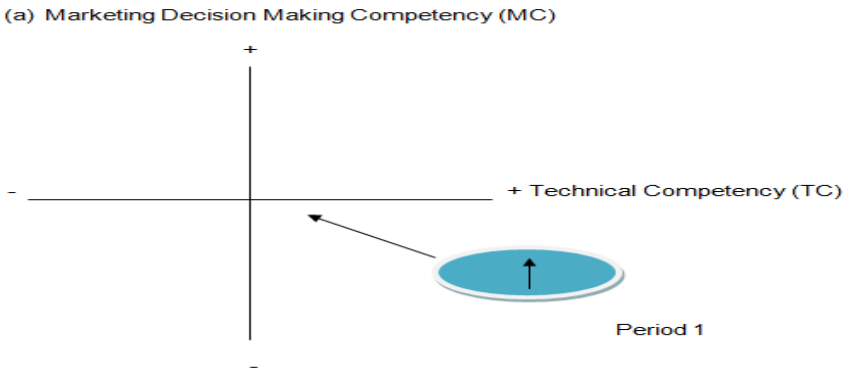

Figure 3 (a): Decision-making and technical competency model (Source: Carson and Gilmore, 2000: 371)

In Figure 3(a), time period 1, Experiential learning (K+E+C+J) will be subjugated by the owner-managers technical competency (TC). His / her marketing management decision-making competency (MC) will be heavily negative in experiential knowledge due to the lack of accumulation. Hence, the quality of decision-making is positioned in the right lower right hand quadrant of the model. This evidently represents a deficiency in marketing management decision-making competency, and dominance or perhaps a dependency on technical competency.

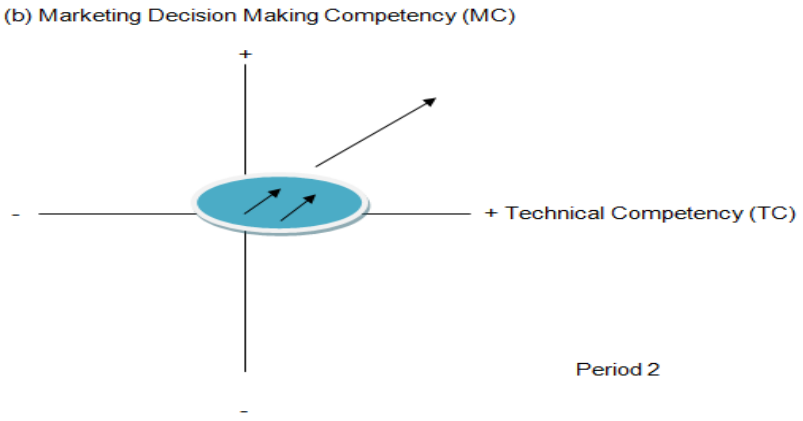

Figure 3 (b): Decision-making and technical competency model (Source: Carson and Gilmore, 2000: 371)

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Figure 3(b), time period 2, illustrates that progress has been made with regards to experiential knowledge in relation to marketing management decision-making competency, however technical competency has suffered to some degree, as a result of time spent in the development of marketing decision-making competencies and because of this, technical competencies were not able to develop further in terms of currency and proficiency.

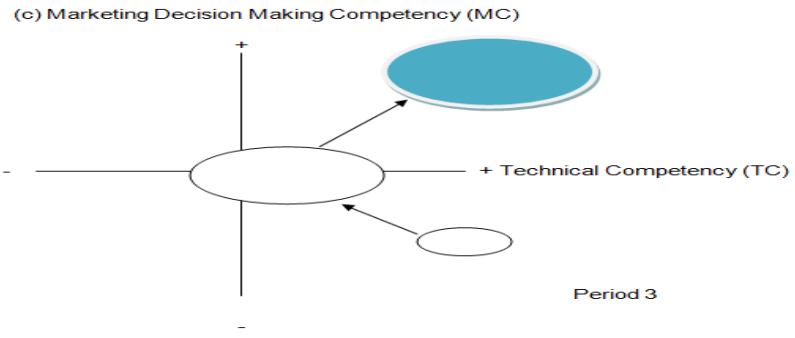

Figure 3 (c): Decision-making and technical competency model (Source: Carson and Gilmore, 2000: 371)

In Figure 3(c), time period 3 illustrates that experiential knowledge with regards to the two key competency areas of marketing decision-making competence and technical competence is now located in the upper right quadrant of the model. This figure illustrates that marketing decision-making competency efficiency has progressed further. As for technical competency proficiency, it has been restored due to the fact that the owner-manager has been able to update as marketing management decision-making competency proficiency has become established.

Taking cognisance of the discussion on technical and decision-making competencies as illustrated in Figure 4, and adding the experiential learning dimensions described in Figure 2, Carson and Gilmore (2000: 372) are of the opinion that the two models can be expanded to create an encompassing model of SME marketing competency development (Figure 4), which takes into account the decision-making and technical competencies and the development and change of emphasis over time in relation to the development of experiential knowledge through experiential learning.

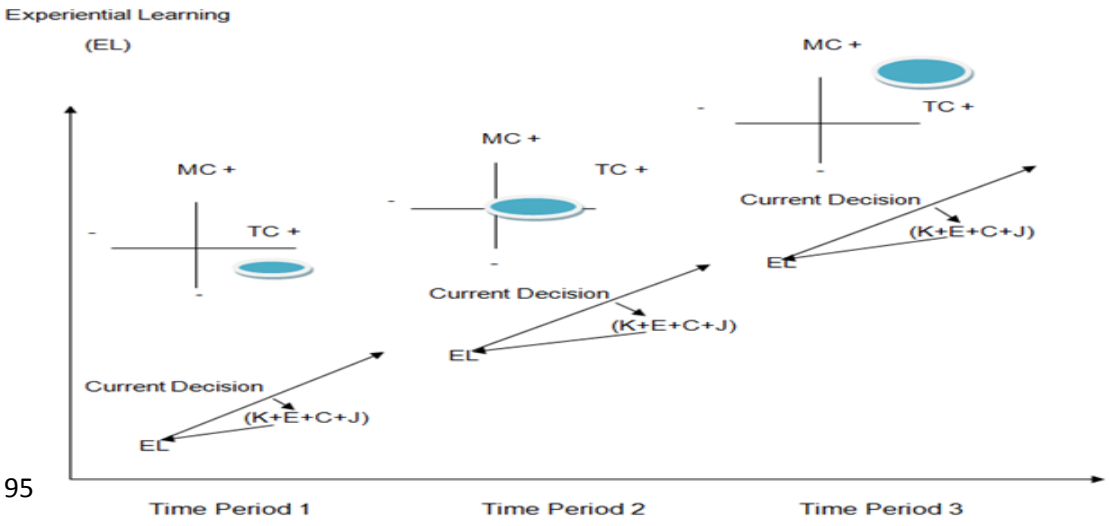

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Figure 4: A model of SME marketing competency development (Source: Carson and Gilmore, 2000: 373)

1.3 Tendering (including estimating) and its challenges with regards to construction SMEs

Woods (2008: 235) defines tendering as a process whereby an organisation invites for the supply of goods and services, and awards the contract to the best offer, according to a predetermined criterion without negotiation. Woods (2008: 235) further mentions that the tendering process can be seen as an essential anti-corruption approach. Moeti *et al.* (2007: 124) are of the opinion that tendering is a proposal to provide goods or service in concurrent competition with other potential suppliers. In terms of the construction industry, Finch (2011: 1) defines tendering as a procedure by which bids are invited from interested contractors to carry out specific packages of construction work. Furthermore, Finch (2011: 1) advises that the tendering procedure should adopt and observe the key values of fairness, clarity, simplicity and accountability, as well as to reinforce the idea that the apportionment of risk to the party best placed to assess and manage it, is fundamental to the success of a project. Gildenhuys (2002: 604) mentions that there are various ways in which tenders can be invited and contracts concluded within the construction industry. These ways are not limited to public tenders, limited public tenders, private tenders, negotiated contracts, serial contracts, divided contracts, and concessions. However, to understand the challenges faced by construction SMEs with regards to tendering and estimating procedures, it is imperative to understand the, public and / or private sector, in which they compete.

During the past decade there has been a trend among governments to privatise services and activities traditionally provided by government. This has increased the use of the public sector to secure the services of private contractors who enter into relationships with public bodies to provide these services or to undertake these activities on behalf of such bodies (Pautz *et al.,* 2003: 1-3). In this context, Pautz *et al*. (2003: 1-3) are of the opinion that the private sector is used as a substitute for government itself. The mechanism for doing so is a contractual relationship whereby government contracts with private organisations in order to provide services, goods or engineering and construction works or any contribution thereof (Nkonge, 2013: 197). From this setting, Pautz *et al*. (2003: 1-3) claim that most construction SMEs in South Africa are more often involved in public procurement processes rather than in private procurement processes. Nkonge (2013: 197) mentions that there have been many issues relating to construction SMEs and the public procurement process. One of the general concerns is that the public procurement process favours large firms, due to their reputation, relationship establishment and resource availability. This in turn discourages small firms from tendering, and thus limiting their access to government contracts (Nkonge, 2013: 197). According to The Association of Chartered Certified Accountants (ACCA) (2009: 7), obstacles that discourage construction SMEs from responding to tenders include:

- The procurement pipeline is opaque and there are basic difficulties in finding information relative to tenders. Information is particularly difficult for construction SMEs to obtain, as they do not normally have the capacity to conduct extensive research for new tenders;
- SMEs lack knowledge with respect to the correct procedures for bidding;

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- The deadline for responding to calls to tender are too short. Construction SMEs generally need more time to prepare competitive offers due to employee related constraints;
- The costs of responding are too high. Since many tendering costs are fixed, construction SMEs face disproportionately high costs in comparison to larger enterprises;
- Tender forms and guidance are often worded in specialist, unclear, and overly complex language;
- The increased complexity of procurement, including form filling, and excessive and complex documentation for small contracts, places an additional administrative burden on construction SMEs, which often lack the employee capacity to engage properly with the process;
- High levels of complexity also mean that construction SMEs do not have the time to work with other agencies on a joint bid by forming a consortium;
- Construction SMEs feel that the public sector prefers bigger contracts as a result of searching for economies of scale. This results in smaller numbers of suppliers being granted contracts;
- Price is over-emphasised by awarding authorities. There are suggestions that prices are driven down as a result of this approach, and that some procurers are interested only in the 'bottom line' rather than an analysis of both cost and quality;
- Pre-qualification requirements can often act as a barrier to tendering, for example, the need to have a certain number of financial reserves;
- There is limited knowledge, experience and expertise on the part of commissioners and procurement professionals in public bodies, especially with regards to their understanding of construction SMEs and how they operate, and
- There is widespread concern that authorities are using procurement as a way of meeting social targets rather than achieving best value for money or a quality service.

In terms of the tendering challenges facing construction SMEs and the public procurement process, Nkonge (2013: 217) provides a conceptual framework which could be considered to address these challenges. This framework is shown in Figure 5 and briefly explained thereafter.

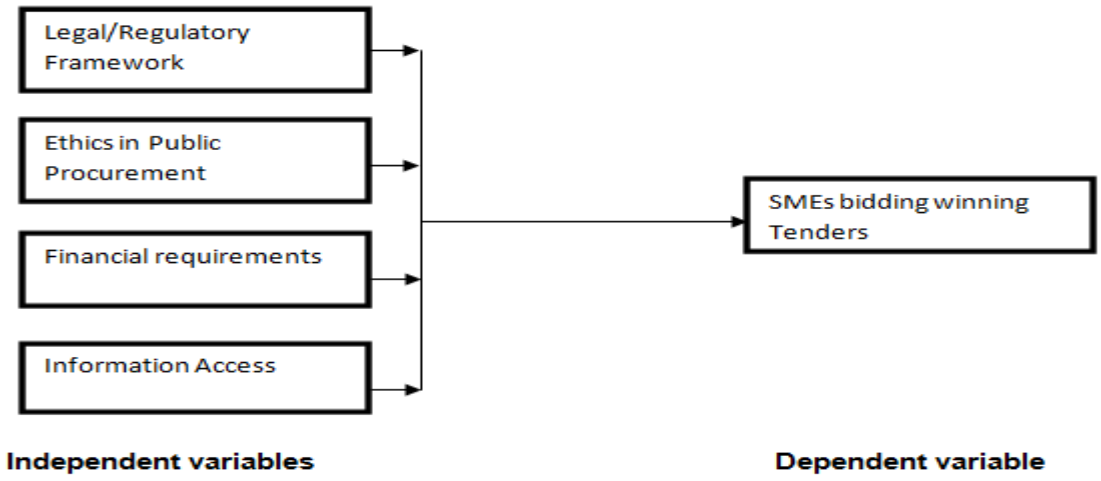

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Figure 5: A conceptual framework to address the tendering challenges faced by construction SMEs within the public procurement process (Source: Nkonge, 2013: 200).

1.3.1 An overview to the above illustrated conceptual framework

The above illustrated conceptual framework consists of five variables, four of which are independent variables and one of which is dependent. The four which are independent are proposed by Nkonge (2013: 200) to work in unison with one another, in order to achieve the dependent variable which is that of SMEs bidding winning tenders.

1.3.2 Legal/Regulatory Framework

According to Nkonge (2013: 200), the legal and regulatory framework establishes the rules within which all the financial institutions, instruments, and markets operate in a given country. In addition, Puddephatt and March (2012) cited by Nkonge (2013: 200) confer that a weak national regulatory framework is often the root of challenges facing SMEs in public procurement. Therefore, the inclusion of the legal / regulatory framework as an independent variable in the proposed conceptual framework allows for the establishment of a base for a competitive and transparent public procurement process, which is relevant for large and small business alike (Nkonge, 2013: 201).

1.3.3 Ethics in Public Procurement

Nkonge (2013: 200-201) opines that the one way for governments to assist SMEs in achieving their full potential is through public procurement system. However, SMEs entry into this potential lucrative market is often hindered by challenges such as corruption, red tape and lack of transparency in tendering, to name a few (Nkonge, 2013: 200-201). The conceptual framework illustrated therefore, includes an independent variable such as ethics in public procurement, to allow for the active disclosure of documentation and the creation of a level playing field for SMEs in public procurement, which in effect would maximise SME growth and indirectly contribute to overall economic development (Nkonge, 2013: 201).

1.3.4 Financial Requirements

According to Ganbold (2008) cited by Nkonge (2013: 202), the ability of SMEs to grow depends highly on their potential to invest in innovation and qualification. All of these investments need capital and therefore access to finance (Nkonge, 2013: 202). Nkonge (2013: 202), further highlights that the consistently repeated complaint of SMEs about their problems regarding access to finance is a highly relevant constraint that endangers the economic growth of a developing country. It is in this regard that the proposed framework includes financial requirements as an independent variable, in order to address the financial issues which are currently faced by SMEs and which affects their bidding process (Nkonge, 2013: 202).

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1.3.5 Information Access

Nkonge (2013: 203) postulates that SMEs need to have access to adequate information to enhance productivity and to facilitate market access. The establishment of an active SME sector and the effective utilisation of quality business information have been identified as crucial in attaining long-term sustainable economic growth for developed and developing countries (Nkonge, 2013: 203). According to Strong *et al.* (1997) cited by Nkonge (2013: 203) poor information quality can create chaos. Ladzani (2001) cited by Nkonge (2013: 203) states that the priority ranking of SMEs' needs clearly puts information provision at the top of the list of services to be provided. It is in this regard that information access serves as part of the conceptual framework illustrated above (Nkonge, 2013: 203).

1.3.6 SMEs Bidding Winning Tenders

Measurement of successful bidding entails various factors that need to be put in place so as to be sure that the bidder wins the tender each and every time he / she bids (Nkonge, 2013: 204). Nkonge (2013: 204) with the above illustrated conceptual framework confers that legal and regulatory framework; ethics in public procurement; financial requirements, and information access are all factors which together could possibly improve the SMEs bidding endeavours.

Apart from the challenges which accompany the tendering process, Ramokolo and Smallwood (2008: 47-48) state that one of the major problems construction SMEs face during the tender process is their inability to estimate costs as well as to assess the effects of inflation. This clearly reflects the lack of training and experience in business and financial management, which in effect thwarts procurement efforts. In the absence of this experience, construction SMEs tend to rely on intuition based on previous experience if any. They also overestimate labour productivity and material transport costs. These vary from one contract to another. Fraser (1985: 5) cited by Chilipunde (2010: 43) provides an overview of the situation:

"The lack of costing skills has led to the under-pricing of contracts. An African Builder also faces heavy financial losses at the end of the project by virtue of the fact that he / she fails to incorporate costs associated with the overheads and contingencies in compiling and quoting for tenders. What most African contractors do, and are very confident of, is the use of the standard rate per m^2 as a means of estimating. This is reinforced by the popular census as to what constitutes an acceptable township rate and the willingness of competitors to undercut any contractor who tries to increase his / her rate. This method of pricing leads to most contractors ending-up with under-pricing, since they tend to use the same rate in all their projects, irrespective of the finishes, structure, allocation of resources and the nature of the foundations. To mention the worst part, 'township rates' in some cases have remained unchanged for the past five years, irrespective of inflation prevailing today and the real value of the Rand in the economy."

Furthermore, Chilipunde (2010: 43) advocates that the apparent lack of understanding of inflation and escalation in the cost of building material clearly present an imposing barrier to

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construction SMEs wishing to compete. Financial institutions in South Africa are reluctant to allow their clients from increasing the original agreed costs. However, this essentially forces construction SMEs to estimate price increases in advance and include an amount for this in their tender. Chilipunde (2010: 43) clarifies this and suggests that it means that construction SMEs would have to assess risk of price increases. Chilipunde (2010: 43) is however of the opinion that construction SMEs are generally unable to manage business risk.

2. Findings

The study clearly identified that SMEs in general and construction SMEs in particular, approach the marketing concept in an informal manner. This is primarily due to the nature of their business, which does not coincide to that of larger firms. However, taking into consideration the high failure rate of construction SMEs, this study highlighted a number of marketing skills challenges, which are exacerbated by the lack of adequate marketing competencies. These include: the ability to access finance; the ability to understand the market and potential for growth; the ability to conduct a market needs analysis; understanding the concepts of market segmentation; access to education and training; the ability to market products and services, and the ability to compete. In addition to this, the study also identifies that most construction SMEs in South Africa are involved in the public procurement process rather than the private procurement process. However, the study raises many issues relating to construction SMEs and the public procurement process. One of them being that the public procurement process in South Africa favours large firms more often which leads to the discouragement of small firms to participate in the tendering process, limiting their access to government contracts. Furthermore, the study emphasises that one of the most prolific problems facing construction SMEs is their inability to estimate costs as well as to assess the effects of inflation. In their entirety, all of these challenges mentioned contribute significantly to the performance and growth of construction SMEs.

3. Conclusions and Recommendations

Based upon the findings of the literature review, it is evident that procurement efforts of construction SMEs are drastically affected due to the lack of marketing and tendering, including estimating, competencies. However, a number of proposed solutions are noted within the literature review. Firstly, a model of SME marketing competency development should be introduced to address the marketing challenges. Secondly, a conceptual framework is proposed to address the tendering challenges. An overall recommendation is that appropriate contractor development programmes be evolved and are the key to developing these marketing, tendering and estimating skills which will in essence address most of the challenges currently being faced by construction SMEs.

It should however be noted that the research study reported on arises from a segment of a literature survey which forms part of a larger study. With this said, cognisance should be taken in that the research is in its initial phase for which findings are best described as exploratory.

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Potential use of desulphurised waste residues in construction applications

Jamal M Khatib[2], Lee Wright[3], Pal S Mangat[4]

Abstract

This paper is part of a wide range investigation on the use of desulphurised waste in construction applications, mainly cement based materials. It presents some results on the porosity and pore size distribution of cement paste containing simulated desulphurised waste (SDW). The SDW was chosen due to the wide variability of real desulphurised waste in terms of its compositions. The SDW is a combination of 85% fly ash and 15% gypsum. The cement was partially replaced with 0, 10, 30 and 70% SDW. The water to binder ratio was 0.5. The binder consists of cement and SDW. The porosity and pore size distribution of cement pastes at 7 days of curing is reported in this work. Increasing the amount of SDW increases the total pore volume in the paste. Also there is tendency to have larger pore size as the amount of SDW increases. However, there may possibilities to use desulphurised waste in construction applications.

Keywords: Desulphurised waste, FGD waste, porosity, pore size distribution, waste

4. Introduction

The construction industry consumes large amounts of raw materials. In order to meet the need of future generation, the consumption at this present rate is not sustainable. Therefore, there is a need to utilise the resources in a very efficient manner and attempts to recycle more.

The coal power industry has been a major cause of pollution due to the burning of fossil fuels. On combustion, these fossil fuels emit sulphur (SO_x), Nitrogen (NO_x) and carbon dioxide (CO_2). For the foreseeable future, many countries such as Eastern European countries, China, India and South Africa will continue to use coal in the production of power until viable alternatives can be found. Over the past decade, there has been increasing

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pressure on governments to reduce the emission of harmful gases. For example, the reduction of SO_2 emissions produced by power installations can be achieved by introducing alkaline sorbents such as limestone to the SO_2 gases, which react and form desulphurised solid wastes. There are different desulphurisation processes used and the majority fits into three main categories; wet, semi dry and dry processes (Mangat et al 2006). Details about the variability in chemical compositions of desulphurised waste are given elsewhere (Khatib et al 2007, Khatib et al 2008). The waste generated is normally sent to landfill and thus attempts to use this waste in construction as partial cement substitute would reduce some of the environmental problem associated with its disposal.

The majority of materials used within the construction industry are porous and the measure of accessible voids with respect to the total volume taken up by the solid material is important as it determines the properties of the materials. The strength and durability properties of materials such as concrete depend heavily on the amount of pores present as well as the size and distribution of such pores. The influence of porosity and pore size distribution on areas such as physical and mechanical development (Odler and Robler 1985, Fuyaka et al 1991), and durability properties (Calleja 1986, Mangat and Khatib 1992) is well documented. Many attempts have been made to correlate porosity and pore structure with the performance of paste, mortar and concrete (Kolias 1994, Jiang and Guan 1999). The main relationships tend to indicate that strength is related to total porosity, whereas, durability tends to be influenced more by pore size distribution as it will affect the permeability of the material. Permeability is a fundamental property which affects the durability. Cement based material with high permeability will allow an easy access to fluid and ions. However, a low permeability material would restrict the flow of fluid and the ingress of ions into it.

Utilising coal combustion residues such as fly as in construction applications is becoming a common practice (Singh and Garg 1996, Wee et al 1995). This paper reports some results on porosity and pore size distribution of cement paste containing simulated desulphurised waste (SDW). The SDW was prepared by combinations 85% fly ash and 15% gypsum and was used as cement replacement. Previous work was shown that simulation yields similar results of actual waste with the same chemical composition (Khatib et al 2008).

5. Experimental

The materials used for this work are CEM-1 cement (C), fly ash (FA), gypsum (G) and water. The oxide compositions of C, FA and G are presented in Table 1. Paste P1 represents the reference paste containing 100% C. In pastes P2 to P4, the cement was replaced with 10, 30 and 70% SDW. The SDW was prepared using 85% fly ash and 15% gypsum (by weight).

Table 2 shows the binder proportion of the mixes. The water/binder was kept constant at 0.5. The binder consists of cement and SDW.

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Table 1 . Chemical composition of binder

	Major Oxide (%weight)							
Material	CaO	Fe_2O3	Al_2O_3	SiO_2	MgO	K_2O	Na_2O	SO_3
Cement (C)	64.80	2.80	4.49	21.10	1.03	0.65	0.15	3.12
Fly ash (FA)	6.74	4.62	31.74	48.91	1.51	1.20	0.60	1.75
Gypsum (G)	35.55	0.07	0.21	0.38	0.02	0.02	0.01	49.20

Table 2. Binder constituents of the pastes

		Proportions (% weight of binder)	
Paste No	**Mix ID**	**Cement (C)**	**SDW**
P1	REF (100_C)	100	0
P2	90_C10_{SDW}	90	10
P3	70_C30_{SDW}	70	30
P4	30_C70_{SDW}	30	70

The pastes were cast in steel moulds of 50mmx50mmx50mm. All samples were placed in a mist curing room at 20ºC±1ºC and 95%±5% relative humidity for 24 hours. After that demoulding took place and cubes were placed in water at 20ºC until testing for further 6 days (i.e total curing for 7 days). After that the cubes were tested for compressive strength and samples were taken from the middle of crushed cube. A suitable sample size used for the analysis was between 0.9 and 1.2g. The samples were dried in an oven at 70ºC until a constant weight was achieved. This usually took approximately 48 hours. Mercury intrusion porosimetry was then used to determine total porosity and pore size distribution (Wild et al 1995, Khatib and Mangat 2003, Khatib and Wild 1996).

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6. Results and Discussion

Figure 1 shows the total pore volume (TPV) of paste containing different SDW contents at 7 days of curing. The TPV of SDW paste is higher than that of the reference paste. The higher the SDW content the larger the volume. The percentage increase in volume is about 30%, 60% and 90% for pastes containing 10, 30 and 70% respectively.

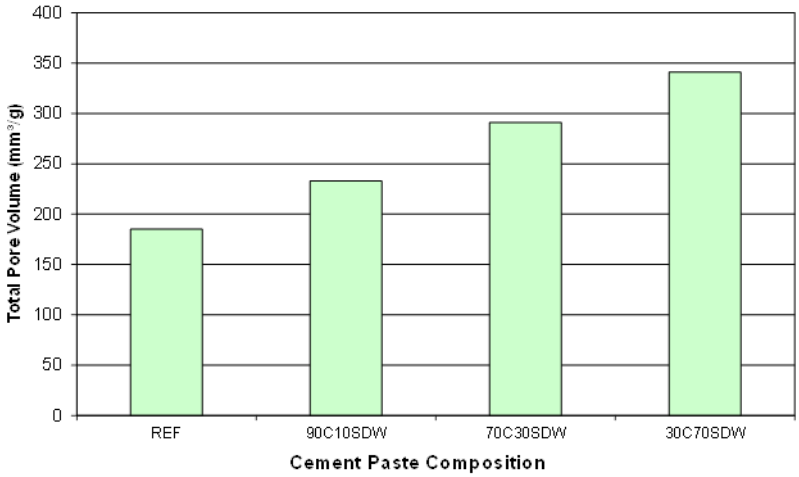

Figure 1. Influence of SDW content on the TPV of pastes

Figures 2 to Figure 5 show the pore size distribution (PSD) for pastes P2 to P4 respectively at 7 days of curing. There was a noticeable difference between the reference mix and pastes containing SDW. An increase in the SDW content increased the pore diameter relating to the initial peak on the pore size distribution curve. The reference paste exhibited an initial peak at about 0.1µm, and a narrow distribution of pores. Pastes containing SDW exhibit a much wider distribution of pores and a less definable initial peak. The initial peak appeared to diminish giving way to a second more rounded peak at approximately 0.1µm. Although this was not observed with the reference paste, it might be a transition point, which was possibly due to the relatively slow hydration of pastes containing SDW. As the SDW content increases, the initial and secondary peak can be identified.

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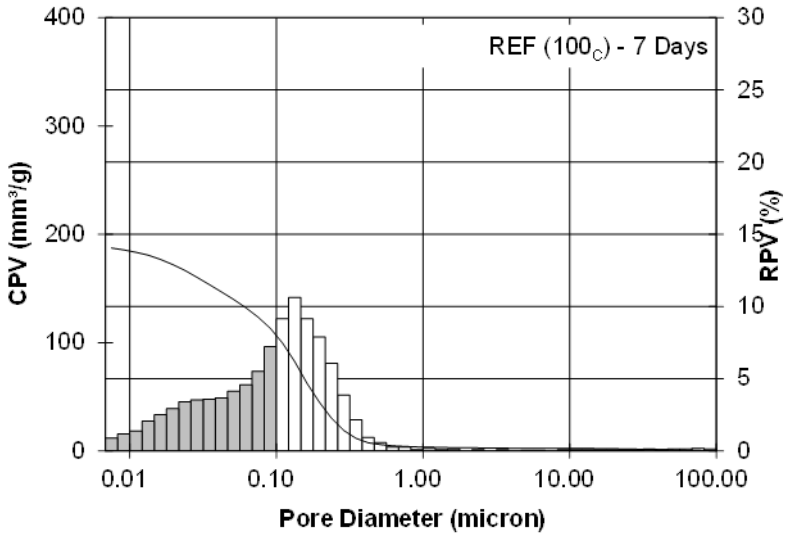

Figure 2. Pore size distribution of the reference paste (P1)

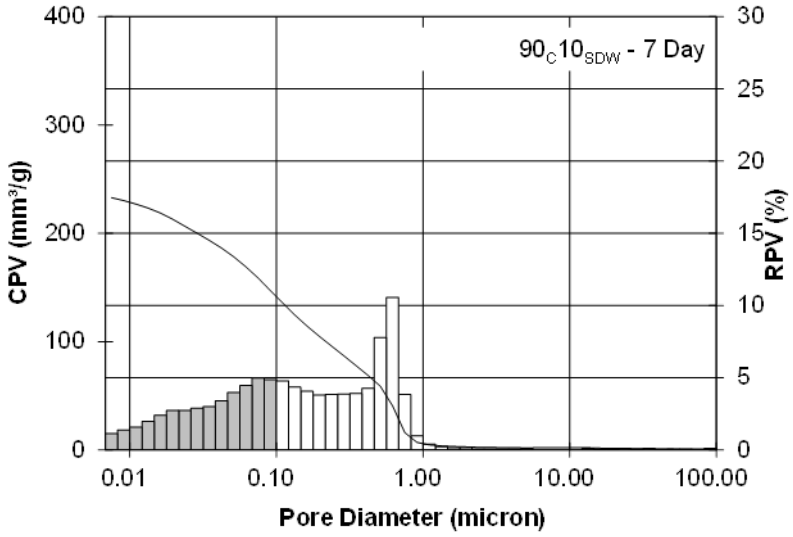

Figure 3. Pore size distribution of paste P2 containing blend of 90%C and 10%SDW as cement replacement

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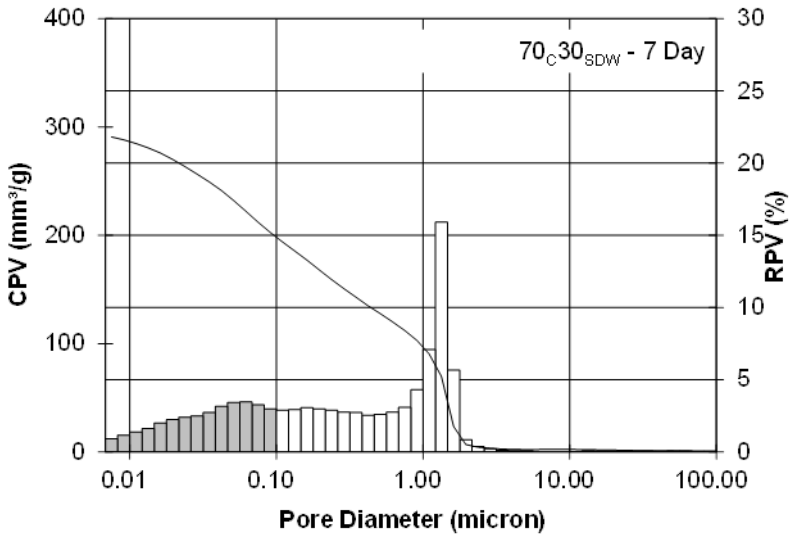

Figure 4. Pore size distribution of paste P3 containing blend of 70%C and 30%SDW as cement replacement

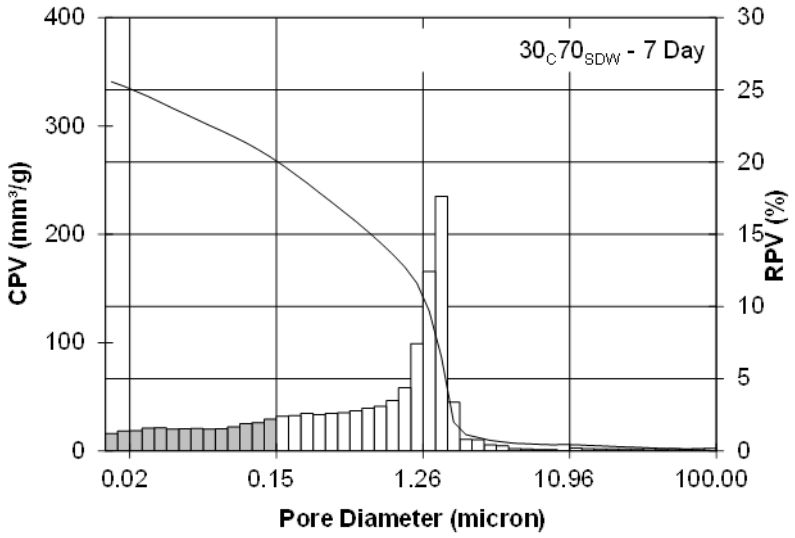

Figure 5. Pore size distribution of paste P4 containing blend of 30%C and 70%SDW as cement replacement

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The threshold diameter (TD) for pastes containing different amounts of SDW is shown in Figure 6. The TD is the diameter on the pore size distribution curve before the pore volume rises sharply. Further information on the determination of the TD was reported elsewhere (Khatib and Wild 1996). A smaller TD tends to indicate a finer pore structure. The reference mix exhibited a TD of 0.13 µm. Replacing cement with 25% fly ash ($100_{FA}0_{G}$) increased the TD to 0.51µm. Replacing the fly ash with increasing levels of gypsum increased the TD from 0.51 µm to 1.31 µm. The TD is linked to the initial peak as shown in Figure 3 and an increase in the TD indicates a coarser pore or a decrease in pore refinement.

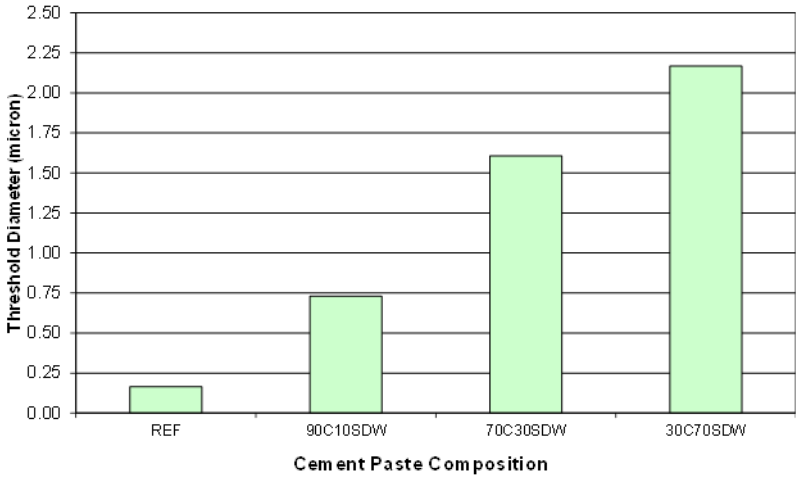

Figure 6. Influence of SDW content on the threshold diameter (TD) of pastes

The percentage of small pores (SP); pores whose diameter is below 0.1 µm is shown in Figure 7 for the pastes containing various amounts of SDW . There seems to be a systematic decrease in the amount of small pores as the content of SDW in the paste increases. This indicates that a coarser pore structure is obtained when SDW is present in the paste.

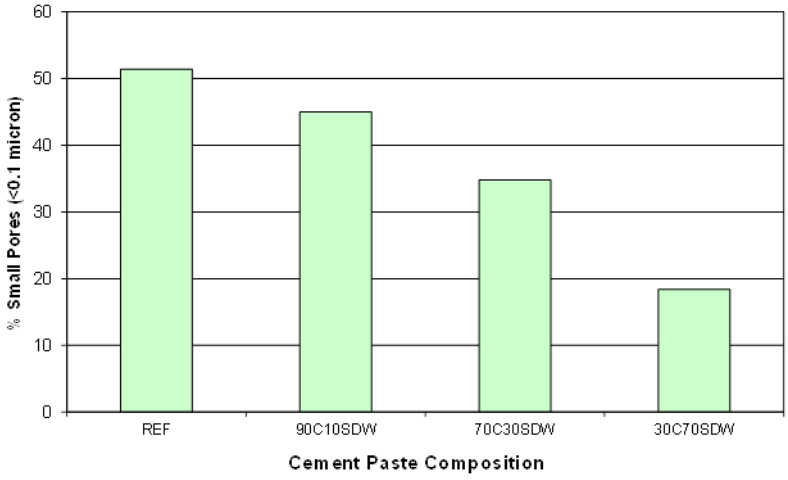

Figure 7. Influence of SDW content on the percentage of small pores (<0.1µm) of pastes

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One possible indication to the alteration of the pore structure is the appearance of a secondary rounded peak on the pore size distributions (PSD). The initial peak corresponds to a transition point between surface and internal porosity, normally defined by the threshold diameter. The secondary peak indicated a bimodal distribution. This could be due to the fineness of the fly ash introduced, or a modification of the pore structure through pozzolanic reactions occurring that fill the capillary pores. The pores then become blocked and inaccessible creating a discontinuous pore structure until the pressure is great enough to break through the formed barriers (Wild et al 1990). Therefore, the pore diameter represented on the PSD may actually correspond to the breakthrough pressure.

Other researchers (Uchikawa 1986) have reported that the reactivity of fly ash could be improved by adding sulphate to increase the reactivity of the fly ash or the formation of sulphate containing C-A-S-H products that form around the fly as particles. However at 28 days this was not evident in the present study where different amounts of gypsum were included in pastes M3-M8. Excessive gypsum replacement can result in a retardation of the hydration process as the ettringite formed on the fly ash particles increases, which temporally retards the reaction with lime (Singh and Garg 1996, Wild et al 1990). This did appear to be the case, especially in the mix containing just gypsum as replacement.

7. Conclusion

Replacing cement with increasing amounts of simulated desulphurised waste leads to an increase in the pore volume, increase in the threshold diameter and an decrease in the amount of small pores indicating a coarser pore structure. At longer curing period the results may be different as shown in a previous investigation. However, this does not mean that desulphurised waste cannot be utilised in cement based application. Previous work indicated that the chemical resistance is improved in the presence of SDW and this makes it suitable for certain application, thus contributing to the sustainability of our environment.

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PRACTITIONERS PERSPECTIVES FOR THE IMPLEMENTATION OF SUSTAINABLE CONSTRUCTION IN THE GHANAIAN CONSTRUCTION INDUSTRY

Simon Ofori Ametepey[1] and Clinton Aigbavboa[2]

Abstract

This paper presents results of a study which assessed the perceptions of Ghanaian construction practitioners of the sustainable construction philosophy and to identify the level of knowledge in the construction industry. A structured questionnaire survey was conducted on practitioners (Architects, Quantity Surveyors and Structural Engineers) in the construction industry to assess their perceptions of the sustainable construction philosophy and to identify the level of knowledge in the Ghanaian construction industry and measures to bridge the knowledge gap. A quantitative approach to data analysis was employed using mean scores of the factors studied. There is the existence of a low level of awareness, and also low level of familiarity and application of sustainable construction principles among practitioners in the Ghanaian construction industry. Majority are considering the application of sustainable construction concepts in future. Construction practitioners suggest that to deal with the knowledge gap, there is the need to train firms and professionals on the concept and principles of SC and the construction industry should organize workshops and conferences to increase the level of awareness and bridge the knowledge gap on sustainable construction in Ghana.

KEYWORDS: Sustainable construction, perceptions, knowledge level, construction industry, Ghana

1.0 INTRODUCTION

The construction industry plays a leading role in terms of economic growth, in addition to producing structures that add to productivity and enhancing quality of life (AGC, 2009). In addition, urban planning, built environment and infrastructure are critical to the growth of towns, regions and countries, for the competitiveness of the economy and for the economic, cultural and social life of the inhabitants. The created assets have very long lives and constitute a considerable proportion of our common environment. This industry is large, complex, diverse and covers a wide range of business interests and activities, united by their common usage and development of land (Corporate watch, 2004).

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On the other hand, there is rising recognition among scientists and leading scholars that the pace at which the earth's resources are being used surpasses its long-term ability and undermines the vital life support system of the earth. The construction industry is no exception to this menace, in view of the fact that it is a major consumer of non- renewable resources and also destroys the natural environment due to its activities.

The relationship between construction activities and the built environment on one hand, and sustainable development on the other hand, is both significant and complicated. Extensive change is now taking place in the construction industry in numerous countries. As a result, the concept of sustainable construction emerged. It is proposed that sustainable construction is the way forward to improve performance of the construction industry, making it more sustainable (Nurni, 2007). In light of the above and the need for restructuring construction industries the world over; developing sustainable construction is a strategically important goal for every country as well as Ghana. We need to think of the future. Being sustainable is one way in which we can guarantee a future with the resources that we require.

Due to the virtues and the growing interest of sustainable construction, there is a huge saddle on stakeholders in the construction industry worldwide to initiate actions to mitigate the negative impacts of construction activities and sharpen their competitive edge. Also, as global interest on sustainability is progressively thriving, Ghana should not be left out in the quest to achieve a sustainable construction industry. There is the need for the Ghanaian construction industry to demonstrate that it can abide by this new interest and can compete in the global market. Nevertheless, to be able to adopt and implement this concept, there is the need for all stakeholders in the construction industry to be conscious and to also have some knowledge about the concept. The application of the SC concept in the Ghanaian construction industry is a new approach, hence the objective of this study, which is to assess the perceptions of Ghanaian construction practitioners of the SC philosophy, identify the level of knowledge in the construction industry and measures to bridge the knowledge gap.

1.1 Conceptual Explanation of Sustainable Construction

The term sustainable construction is a cross-cutting matter and means different things to different persons. The review of related works shows multiple definitions exist (e.g. Kibert 1994; Wyatt, 1994; DETR, 2000; Langston & Ding, 2001) and there is discrepancy in terms of scope and context. For simplicity, sustainable construction is best described as the subdivision of sustainable development and its application to the construction industry. The construction industry involves all who plan, develop, produce, design, modify or maintain the built environment and includes manufacturers and suppliers of construction materials, clients, contractors, consultants and end users of facilities (CRISP, 2000). Therefore, sustainable construction could be best described as a subset of sustainable development, which encloses matters such as tendering, site planning and organization, material selection, recycling, and waste minimization (Ding, 2001). In most literature, a common definition of sustainable construction, 'the creation and responsible management of a healthy built environment based on prudent use of resources and ecological principles' (Kibert 1994) and a myriad of other definitions(e.g. Roodman & Lenssen, 1994, 1995) focused more on the environmental aspect of sustainability. Others, for example Wyatt (1994) stated that 'sustainable construction philosophy requires a 'cradle to grave' appraisal of project, which involves managing the serviceability of project during its life- time and eventual deconstruction' focus on the economic aspect of sustainability. Only a few of the existing definitions are comprehensive and capture the entirety of the concept. A good example of this is, 'sustainable construction comprises several processes through which a profitable and competitive industry delivers built assets to improve quality of life and stakeholder satisfaction' (DETR, 2000).

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1.2 Principles of Sustainable Construction

In terms of the principles of sustainable construction, various efforts have been made to analyze a number of definitions of sustainability in an effort to enunciate principles to be upheld in accomplishing sustainable construction. Amongst the published work relating to the principles of sustainable construction are Kilbert (1994), Hill (1994), Lindle (1994), Robert (1995), Hill and Bowen (1997), Graham (2000), DETR (2000), and Long (2001). According to DETR (2000), the principles of SC are: Profitability and competitiveness, customers and clients' satisfaction and best value, respect and treat stakeholders fairly, enhance and protect the natural environment, and minimize impact on energy consumption and natural resources. Hill and Bowen (1997) also stated the principles of SC according to the pillars of SC: Social pillar - improve the quality of life, provision for social self-determination and cultural diversity, protect and promote human health through a healthy and safe working environment and etc. Economic pillar **-** ensure financial affordability, employment creation, adopt full-cost accounting, enhance competitiveness. Technical pillar **-** construct durable, functional, quality structure etc. These principles are contained within a set of over-arching, process-oriented principles (e.g. prior impact assessment of activities). On the other hand, Miyatake (1996) and CIB (1999) stated that the principles of SC embraces Minimization of resource consumption, maximization of resources reuse, use of renewable and recyclable resources, protection of the natural environment, create a healthy and non-toxic environment, and pursue quality in creating the built environment. Cole and Larsson (1999) observed SC principles as reduction in resource consumption (energy, land, water, and materials), environmental loadings (airborne emissions, solid waste, liquid waste) and improvement in indoor environmental quality (air, thermal, visual and acoustic quality). Kibert (1994) classified the principles of SC as minimization of resource consumption; maximization of resource reuse; use renewable and recyclable resources; protect the natural environment; create a healthy and non-toxic environment; and pursue quality in creating the built environment. In broad-spectrum, there is an agreement that the extent of the principle of sustainable construction reflects those of sustainable development, which is about synergistic relationships between economic, social and environmental aspects of sustainability.

1.3 Sustainable Construction Implementation

Sustainable construction can be effectively implemented if a lot more efforts are made to enhance the level of environmental awareness and civic consciousness among stakeholders to carry out construction activities sustainably. There are a lot of benefits linked to the implementation of sustainable construction. Construction practitioners worldwide are beginning to appreciate sustainability and acknowledge the advantages of building sustainably. For example, the concept of sustainable building saves energy as demonstrated by Hydes & Creech (2000). This was further supported by Heerwagen (2000), Bartlett & Howard (2000) and Pettifer (2004), who added that sustainable buildings will contribute positively to better quality of life, work efficiency and healthy work environment. Yates (2001) explored the business benefits of sustainability and concluded that the benefits are diverse and potentially very significant. The approach of sustainable construction and with its underlying principles provides a comprehensive guide to enable the construction players to be more responsible to the environmental protection needs without neglecting the social and economic needs in striving for better living.

On the other hand, there are also several potential barriers to the implementation of sustainable construction with the main one being perceived cost. The common perception about sustainable buildings appears to be that they cost more than ordinary buildings. They increase initial costs by an average of 2 to 7 per cent over ordinary building cost, and only some projects can recoup overall net costs in a short period. Decision makers rarely use

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whole life cycle costs to estimate reduced operating expenses. These barriers can be surmounted by moving the thoughts of stakeholders from cost to value and from short-term to long-term.

2.0 METHODOLOGICAL FRAMEWORK

This research is largely placed within a deductive methodological approach of reasoning, thus employed a combination of primary data (i.e. survey questionnaire) and was supplemented by secondary source of data (i.e. literature review) to present informative evidence on the practitioners perspectives for the implementation of sustainable construction in Ghana. A structured questionnaire survey which targeted practitioners; specifically architects, quantity surveyors (QS) and structural engineers (SE) was used in the study. The research adopted practitioners who are registered with their various professional bodies. This is due to lack of list of practitioners within the construction industry in Ghana. Architects, QSs and SEs were used for the reason that they were the only practitioners within the construction industry in Ghana who have recognized professional bodies i.e. Ghana institution of engineers (GhIE), Ghana institution of surveyors (GhIS) and Architect registration council of Ghana (ARCG). For the sample selection, stratified sampling technique was employed in the selection of the three groups of practitioners. The three groups of practitioners i.e. architects, QSs, and SEs were employed as the strata in stratification to allow for a proportional representation of practitioners across board. Simple random method was then employed in selecting the practitioners within the various strata to avoid researcher biases in the selection. Available records indicated that the ARCG had 333 architects (ARCG, 2013), the GhIS had 75 quantity surveyors (GHIS, 2013) and the GhIE had 5 structural engineers (GhIE, 2013). A sample size of 100 practitioners was determined using the following formula recommended for such studies by (Israel, 2007). $n = \frac{N}{1+N(e)^2}$; Where: n = sample size, N = population size, e = desired level of precision (±5%).

Both closed and open-ended questions were administered to respondents. The questionnaire was divided into three sections. The first part sought information about the respondents' profiles, category of organization working with, educational qualification and level of experience of respondents. The second part of the questionnaire sought to assess respondents' familiarity with the SC principles. The third part dealt with the benefits of sustainable construction and measures to bridge the knowledge gaps on sustainable construction. Concerning the principles of sustainable construction, the respondents were asked to indicate their level of agreement to the application of the principles on a five-point Likert scale (from 1= 'highly disagree' to 5 = 'highly agree'). The respondents were also asked to score benefits of sustainable construction from 1 = 'highly unbeneficial' to 5 = 'highly beneficial', and measures to bridge the knowledge gap from 1 = 'highly unimportant' to 5 = 'highly important'. Each questionnaire was administered through a face-to-face session, which ensured that 86 questionnaires out of the 100 were returned complete and used in the analysis, representing a response rate of 86%.

A quantitative approach to data analysis was employed. Statistical Package for Social Scientists Version 16 (SPSS V16) was used to analyse the data. Descriptive statistics particularly mean and standard deviation were employed for the analysis. Mean scores of the factors and their standard deviations were graphically compared. A factor is deemed to be significant to the study if it has a mean value of 2.50 or more (Field, 2005).

4.0 RESULTS AND DISCUSSIONS

4.1 Background of Respondents

The average years of experience of the respondents surveyed in the construction industry are between 10 and 20 years. This implies that all the practitioners have significant experience in the construction industry. For the profession of the respondents, Architects

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constituted 58%, quantity surveyors constituted 36% and structural engineers constituted 6%. Thirty-Three percent of the respondents had bachelors' degree, 31% had Post-graduate diploma certificates and 4% had Higher National Diploma (HND) certificates. The study further showed that 23% of respondents had Master's degree whilst 9% had doctorate degree. The results also showed that majority of the practitioners (55%) work with consultancy firms. Thirty-one percent of respondents work with client organisations whilst 14% work with Contractor organizations.

4.2 Familiarity with the concept of sustainable construction

On the level of awareness of SC, 83% of the practitioners indicated that they have heard of the concept. Only 17% of the respondents had not heard of the concept. However, for the 83% of practitioners who have heard of SC, 71% heard of the concept through academic work, 10% through Workshop/ Conferences and 10% through the Media. Furthermore, 6% of the practitioners became aware of the concept through Magazines and Newsletters and 3% through Internet. This question was asked to find out the means through which the concept can be promoted in Ghana. Besides, the results corroborates the fact that the concept of sustainable construction can be promoted through academic work.

The results further revealed as presented in figure 1 that 37% of the respondents indicated to have low awareness and knowledge of sustainable construction, 36% claimed to have very low awareness of the concept whilst 22% indicated to have moderate awareness and knowledge of the concept. On the other hand, only 3 % and 2% of the respondents stated that their awareness and knowledge level of sustainability was good and excellent respectively. The result implies that there is a knowledge deficit of the concept as far as practitioners are concerned. However, to be able to adopt and implement these concepts in the construction industry in Ghana, there is the need for all stakeholders in the construction industry to be conscious and to also have some knowledge about the concept. This result differs slightly from a study conducted by AlSanad, Gale and Edwards (2011) in Kuwait. Their study revealed that respondents had moderate level of awareness and knowledge about the concept of sustainable construction. This suggests that their level of awareness and knowledge is a little bit ahead of the respondents in this study.

According to figure 1 the study showed that 68% of the respondents indicated that their level of application of sustainable construction principles is very low while 23% stated that there is a low level of application of sustainable construction principles in their work. Six percent of the practitioners stated a moderate level of application of the principles of the concept. However, 2% and 1% of the respondents indicated that their level of application of the concept is good and excellent in that order. This result is not astounding since most of the respondents' level of awareness and knowledge of the concept is low hence will not apply the concept in their work. This finding also diverges a little from the study conducted by AlSanad, Gale and Edwards (2011) in Kuwait. Their study revealed that respondents' level of application of the concept of sustainable construction were moderate.

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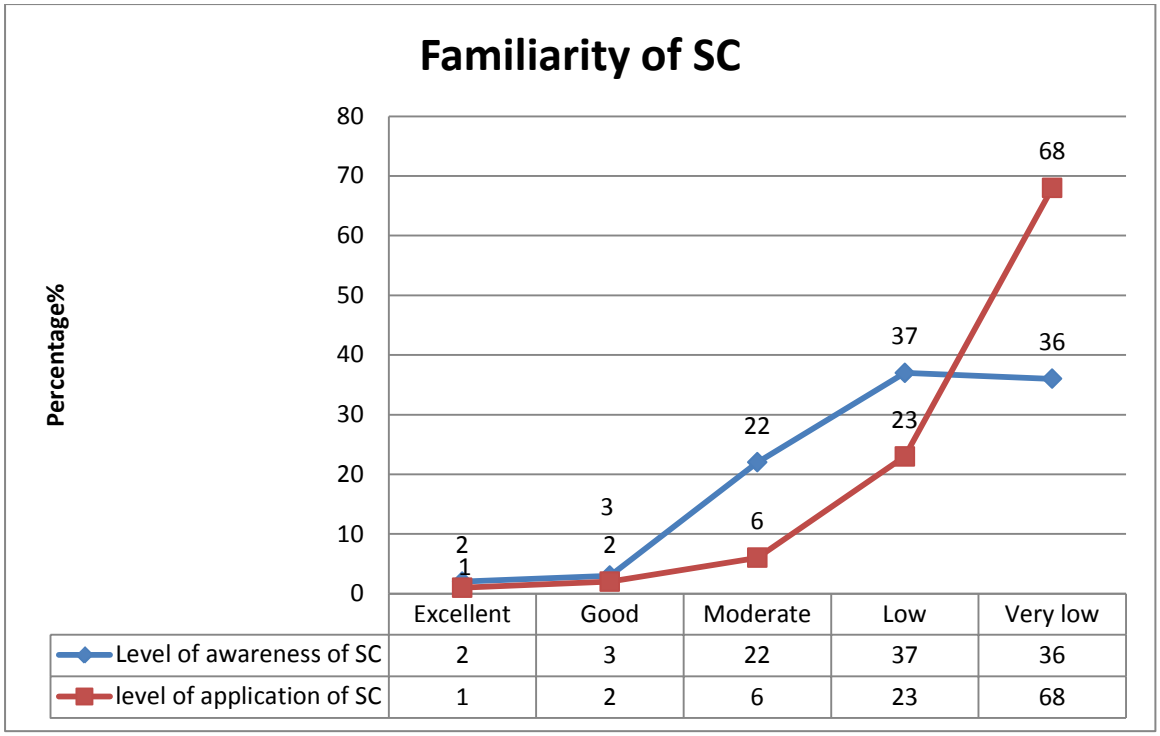

Figure 1: Percentage scores of familiarity of SC

To further assess whether the respondents will implement the concept of sustainable construction by legislation from government or shall do it in their own capacity, 94% of the respondents overwhelmingly agreed that rules and legislation from government will be required to enforce the concept thereby binding them to implement it. However, 6% of the practitioners were of the view that they do not need laws to implement SC. This result agrees with the findings of AlSanad, Gale and Edwards (2011) study. This response also corroborates the fact that in Ghana, the concept will not be implemented unless it is imposed as legislation by government.

4.3 Application of sustainable construction principles

On the level of agreement of respondents to the application of basic principles of SC, the results (Table 1) show that all the 15 principles of SC assessed have mean scores greater than 2.5 (Field, 2005) for the various practitioners. This indicates that the respondents agree that all the fifteen basic principles of SC should be considered during project implementation. The results further show that the respondents consider 'protection of the natural environment', 'use of renewable and recyclable resources', 'improve the quality of life', 'construct durable, functional, quality structure', and 'reduction in resource consumption (energy, land, water, and materials)' as the first five important SC principles to be considered in project implementation. Other important principles include 'improvement in indoor environmental quality (air, thermal, visual and acoustic quality)', 'profitability and competitiveness' and 'respect and treat stakeholders fairly'. The above results agree well with a number of researchers on the principles of SC (Kilbert, 1994; Hill, 1994; Lindle, 1994; Robert, 1995; Hill & Bowen, 1997; Graham, 2000; DETR, 2000; and Long, 2001).

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Table 1: Ranking of Principles of Sustainable Construction

Principles of sustainable construction	Mean	Standard Deviation	Rank
Protection of the natural environment	4.72	0.76	1
Use of renewable and recyclable resources	4.66	0.89	2
Improve the quality of life	4.58	0.65	3
Construct durable, functional, quality structure	4.32	0.85	4
Reduction in resource consumption (energy, land, water, and materials)	4.3	0.91	5
Improvement in indoor environmental quality (air, thermal, visual and acoustic quality)	4.27	0.72	6
Profitability and competitiveness	4.23	0.88	7
Respect and treat stakeholders fairly	4.16	0.69	8
Customers and clients' satisfaction and best value	4.08	0.82	9
Create a healthy and non-toxic environment	4.03	0.76	10
Reduction in environmental loadings (airborne emissions, solid waste, liquid waste)	3.98	0.73	11
Ensure financial affordability	3.92	0.93	12
Maximization of resource reuse	3.84	0.87	13
Employment creation	3.64	0.62	14
Adopt full-cost accounting	3.35	0.98	15

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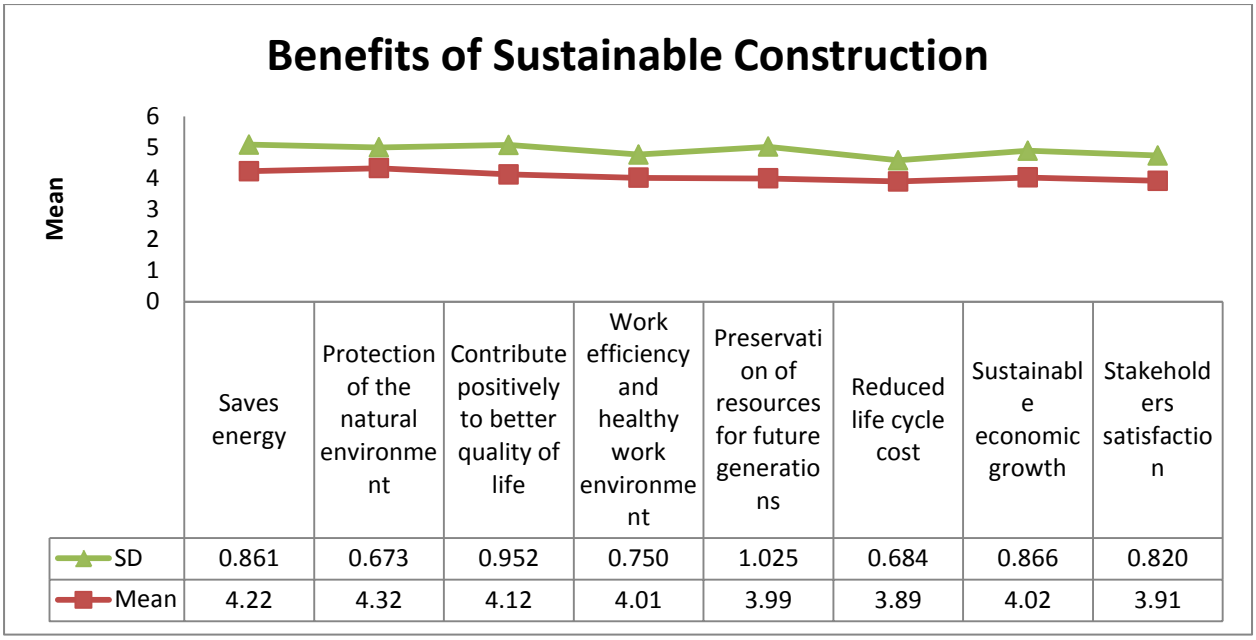

	Saves energy	Protection of the natural environment	Contribute positively to better quality of life	Work efficiency and healthy work environment	Preservation of resources for future generations	Reduced life cycle cost	Sustainable economic growth	Stakeholders satisfaction
SD	0.861	0.673	0.952	0.750	1.025	0.684	0.866	0.820
Mean	4.22	4.32	4.12	4.01	3.99	3.89	4.02	3.91

Figure 2: Mean scores of Benefits of Sustainable Construction

4.4 Benefits of sustainable construction

The respondents were asked to assess eight benefits of SC collected from the literature. Mean scores and rankings of the benefits are presented in Figure 2. In the opinion of the practitioners the first three most important benefits expected from the application of SC are 'saves energy', 'protection of the natural environment' and 'contribute positively to better quality of life'. Other benefits include 'preservation of resources for future generations' 'reduced life cycle cost', 'sustainable economic growth' and 'stakeholder's satisfaction'. The results show that all the benefits of SC evaluated have mean scores greater than 3.50, indicating that they are all highly beneficial to the construction industry. The findings from this study confirm those from the literature. Long (2001), Graham (2000) and Hill and Bowen (1997) reported of benefits from LC such as 'saves energy', 'contribute positively to better quality of life', 'contribute positively to better quality of life and 'sustainable economic growth'.

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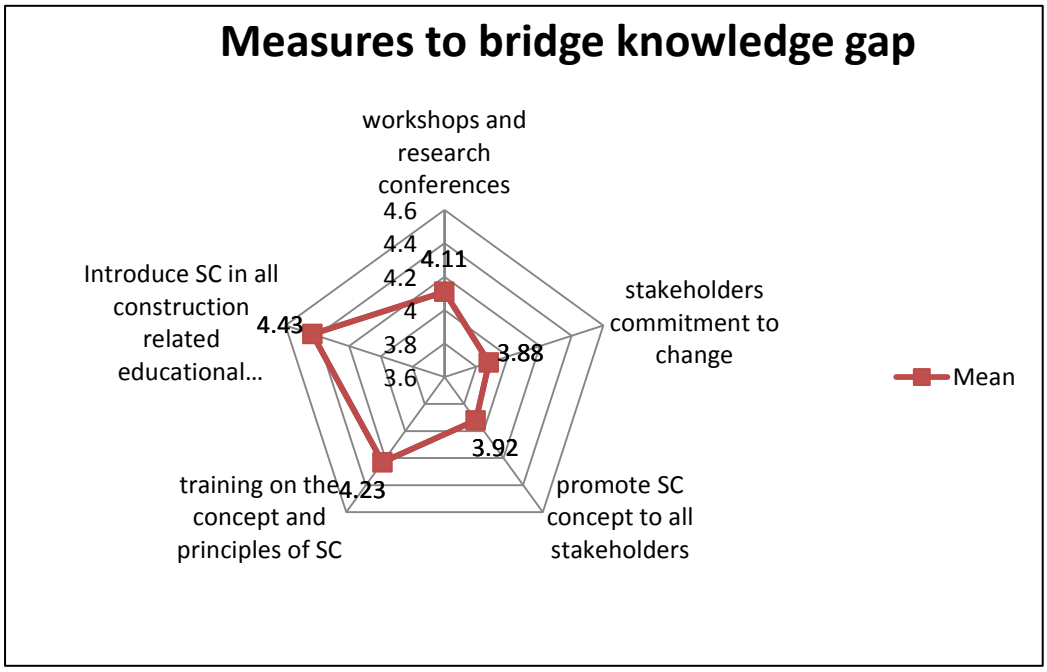

Figure 3: Mean scores of measures to bridge knowledge gap of SC

4.5 Measures to bridge the knowledge gap

In the opinion of the practitioners, the first three most important measures to bridge the knowledge gap as presented in figure 3 are 'introduce SC in all construction related educational programmes, 'Training of firms and professionals on the concept and principles of SC' and 'The construction industry should fund workshops and research conferences to promote transfer of knowledge on SC. Other equally important measures to bridge the knowledge gap are 'stakeholders in the industry should be committed to change', and 'Promotion of SC concept to all stakeholders'. All the measures assessed in the study have mean scores greater than 2.5 (Field, 2005) and therefore considered significant and important for bridging the knowledge gap on SC.

5.0 CONCLUSION AND RECOMMENDATIONS

This study has shown there is a low level of awareness and knowledge among practitioners in the Ghanaian construction industry on the concept of SC. Therefore the level of application of the concept is also very low. However, the study revealed that rules and legislation on sustainable construction from government will be required to enforce the implementation of sustainable construction principles in Ghana. Principles adopted by construction project implementers in their activities such as 'protection of the natural environment', 'use of renewable and recyclable resources', 'improve the quality of life', 'construct durable, functional, quality structure', and 'reduction in resource consumption (energy, land, water, and materials)' are found to be generally consistent with SC practice. Majority of the construction professionals surveyed are open to sustainable construction principles implementation in the construction industry, and are also of the opinion that the implementation of SC principles into the construction industry would bring a lot of benefits including 'saves energy', 'protection of the natural environment' and 'contribute positively to better quality of life'. In order to bridge the knowledge gap, it is suggested among others that there is the need to introduce SC concept in all construction related educational programmes, training of firms and professionals on the concept and principles of SC and

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also construction industry should fund workshops and research conferences to promote transfer of knowledge on SC. The adoption of SC would prove to be rewarding in these regards. Further research is suggested on the perceptions of construction clients of the SC philosophy.

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URBAN LAND READJUSTMENT AS A STRATEGY FOR PROVISION OF BULK INFRASTRUCTURE AND LOW COST HOUSING IN ZAMBIA

Daniel Apton Phiri[1]

Abstract

This paper discusses the potential of the urban land readjustment technique to leverage rural-urban land for provision of bulk infrastructure, services and low cost housing at little or no cost to public agencies. The paper reviews the challenges public agencies face in provision of bulk (network) infrastructure and low cost housing in the wake of rapid urbanization especially on the rural-urban fringes. The land re-adjustment technique and its potential benefits and limitations are discussed and the application of the technique in case studies briefly outlined. Key lessons and conclusions are drawn from the review and appropriate recommendations made for application of the technique in Zambia.

Many towns in Zambia are struggling to respond to rapid urbanization and are challenged to provide adequate and affordable housing, bulk infrastructure and services. In the major cities, like Lusaka, the need is more pronounced on the rural urban fringes where new urban development is rapidly occurring in an uncontrolled and uncoordinated manner. Public agencies are unable and incapable of providing the bulk infrastructure and low cost housing resulting in poorly serviced and slum like peri-urban areas. Lack of funding, capacity and adequate land has often been cited as the reasons for lack of action but public agencies are also short of clear strategies for provision of bulk infrastructure and land for housing.

Land readjustment is both a technique and tool that if effectively applied can support the provision of bulk infrastructure and low cost housing in Zambia. It brings together landowners in a partnership with public agencies for voluntary land contribution or sharing, joint spatial planning and servicing of adjoining plots.

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It entails equitable sharing of costs and benefits of projects among key stakeholders. Successfully applied in Germany, Japan, South Korea, Thailand and other countries, the technique has many potential benefits to enable sustainable urban development on the rural-urban fringes through planned and managed urban extensions supported with bulk infrastructure and affordable housing in Zambia.

Key words: Urban Land Readjustment, Bulk infrastructure, Services, Housing

1. Introduction

Many towns in Zambia are struggling to respond to current rapid rates of population growth and urbanization, and are thus challenged to provide adequate and affordable housing, public bulk infrastructure, serviced land and safe public spaces. These challenges have resulted in marginalization of many urban dwellers leading to high incidences of poverty, unhygienic living conditions and informal economics with limited opportunities for upward mobility. Women, youths, the aged and new migrants to towns bear the brunt of spontaneous and disorderly urban expansion. On the rural-urban fringes urban development is occurring vary rapidly and in an uncontrolled and uncoordinated manner. A key element of these challenges is the lack of serviced land that is connected with the rest of the city and supported with bulk infrastructure and services.

Faced with limited resources and capacity, public agencies are unable and incapable of undertaking effective urban planning and urban development processes that embrace all stakeholders and result in broad range of benefits provision of serviced and affordable housing the expanding population.

Central and local governments face severe capacity gaps, which prevent them from undertaking the necessary governance, legislative and land administration reforms necessary to adapt existing institutional structures and regulatory frameworks to emerging urbanization trends and thus help increase supply of serviced land. There is limited urban planning particularly “forward planning” that is conducted to manage and coordinate urban development especially on the rural-urban fringes. There is also limited knowledge of appropriate tools to facilitate sustainable urban development, particularly tools related to negotiated urban land acquisition, provision of serviced land and affordable housing. Thus there is an urgent need for new and innovative land based tools and techniques to address urban development challenges and to contribute to planned, inclusive and sustainable towns and cities in Zambia.

This paper discusses the potential of the urban land readjustment as a tool and technique to leverage rural-urban land resources and enable the provision of serviced land and related bulk infrastructure and low cost housing at no or little cost to public agencies. The paper highlights the key challenges public agencies face in provision of bulk infrastructure and low cost housing in the wake of rapid urbanization. There are several land based instruments and tools such land readjustment and pooling, urban land taxation, land banking, public private partnerships and town planning schemes that can be used to mobilize resources, particularly land and funding for provision of bulk infrastructure and low cost housing. This

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paper highlights the potential benefits and limitations of urban land readjustment as a strategy for provision of services, bulk infrastructure and low cost housing in Zambia. Key lessons and conclusions are drawn from the review and appropriate recommendations made for provision of bulk infrastructure and low cost housing provision in Zambia.

2. Infrastructure and housing challenges in Zambia

In Zambia the provision of bulk (network) infrastructure and low cost housing falls far behind both need and demand and are widely neglected areas especially on the rural urban fringes where rapid urbanisation and gentrification of rural farmland is taking place. Investment in social infrastructure is not adequate leading to poor service provision and critical shortages of essential infrastructure such as roads, water supply, sanitation, drainage and electricity and adequate housing especially for low income groups. Public agencies and service providers are grossly under-funded and have to struggle to maintain the status quo or respond to urban sprawl. The upfront costs of network supply to plots appear to reduce demand for extensions to formal supply. Service provides face the dilemma of providing cheap services and ensuring viable cost recovery to continue supplying new and maintaining the existing bulk infrastructure and extensions.

In the long term, the balance between costs and sustainable provision must be struck if the current 640,000 and the future 1.3 million extra households in urban Zambia can be provided with infrastructure by 2030. In unplanned and peri urban areas, the informal sector and community groups assisted by NGOs are trying to fill up the gap but cannot keep pace due to rapid informal developments especially on the rural urban fringes. The dominant technologies being used (e.g. septic tanks and soak-aways and pit latrines) cannot be provided at scale to service large populated areas with attendant problems of ground water pollution. Electricity is poorly provided and many households rely on charcoal for cooking and heating and candles or paraffin for lighting resulting in deforestation of the surrounding rural areas. Paved roads are virtually missing or even too narrow to provide access to plots. The overall result are poor quality of the urban environment, deterioration and degradation of the physical space, acute deficiencies of shelter, slum like conditions and poor quality of life for the residents.

The housing deficit, particularly for low income groups, is huge at over two million housing units and is likely to increase to 3 million by 2030 (UN Habitat, 2012). This lack of adequate and affordable housing has significantly contributed to the proliferation of informal unplanned settlements, which in Lusaka alone are home to over two thirds of the population. The demand for urban land for residential and other uses has in recent years increased significantly due to rapid population growth and rural to urban migration. In Lusaka, the capital city, much of the urban sprawl is occurring on customary land, where the land is cheap but the supply of serviced land is in short supply. Urban land is expensive in Zambia's urban centres is partly because the plots are generally large by international standards. The minimum lot size in high-density areas is 12x24m or 288 square metres, medium density areas is 18x30m or 540 square metres and high cost/low density the minimum lot size is 30x45m or 1350 square metres. According to UN Habitat (2012) plot size standards are likely to be very influential in the impact of 1.3 million new housing units by 2030. These very

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large plots lead to very low densities, long servicing lengths and the sprawling of urban development to the detriment of provision of affordable low cost housing.

Prior to the 1990s all undeveloped land in Zambia was vested in the President and had “no value” under the Land (Conversion of Titles) Act of 1975. However, with privatisation and economic liberalisation land has become a commodity which can easily be exchanged in an emerging land market. Within the urban core land for residential purposes is almost exhausted and has become very expensive acquire by ordinary Zambians. Many people are now seeking to build on the rural urban fringes, where customary land is cheap but also where development and planning controls are very weak. Public agencies are aware that unless measures are taken to increase the supply of serviced land, not only will housing shortages intensify but urban development especially on the urban fringe will be unsustainable.

Land is consumed at a very rapid rate and is in short supply in the urban areas, but it is arguably readily available and an underutilized resource on the rural-urban fringe in customary areas. There may be complexities in converting traditional land to state (public) land but this is possible with the agreement of traditional authorities. In fact the new planning law will compel Chiefs to enter into planning agreements with local governments to plan their areas. While public agencies are contemplating the sustainable development of rural urban fringe areas, some traditional authorities are busy allocating land to individuals who eventually convert to private land on title and make public acquisition of land for provision of infrastructure and affordable housing even more complex.

Urban Development (Master) Plans may exist and even outline the basic infrastructure layout and new low cost housing areas but there are no clear implementation and funding strategies to realise the Plan objectives. The rural-urban fringe, which falls under customary (traditional) land are not properly planned for resulting in uncontrolled, uncoordinated and haphazard physical development with huge environmental, economic and social consequences. Lack of funding, inadequate public land and institutional capacity and the absence of clear policies and strategies for provision of serviced land, bulk infrastructure and low cost housing are major constraints.

Public agencies have limited resources and capacity and lack appropriate tools negotiate land acquisition from private landowners for provision of bulk infrastructure and low cost housing. Much of the urban land, even on the rural-urban fringe is in private hands making land acquisition a complex issue even for government agencies. The failure or incapacity of public agencies to mobilize local resources to provide serviced land, bulk infrastructure, basic services and housing is a challenge. While public agencies in Zambia have tried to finance bulk infrastructure and housing through public private partnerships with Pension Funds, Insurance and Building Societies and funds from capital markets and grants, loans, advances or contributions from bilateral and multilateral agencies, they have not fully utilised land based instruments and tools such as land re-adjustment or pooling. This paper argues that land based tools can as effectively be used to provide bulk infrastructure as other conventional financial instruments.

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3. Land Readjustment: Benefits, Conditions for Success and Steps

Archer (1983) defines urban land readjustment/pooling as a technique for carrying out the unified servicing and subdivision of separate landholdings for planned urban development. It is also known as urban land consolidation, land readjustment, land re-plotting, and land redistribution. It is widely used in Australia, Canada Germany, Indonesia, Japan, Malaysia, Nepal, Thailand, South Korea and Taiwan. A similar technique known as plot reconstitution is used in some cities in India. Between the countries, there are both intrinsic and legal differences in approach, preparation and implementation procedures of the technique and in the terms which relate to the transfer of ownership and usage of the land respectively. In land pooling private land is legally consolidated by the transfer of ownership of separate land parcels to responsible agency with a later re-transfer of ownership of new plots back to the landowners. In land readjustment land parcels are only notionally consolidated with the agency having the right to design, service and subdivide them on a unified basis and then at the end of the project the landowners exchange their land parcel title documents for those of the new plots (ibid, 1983).

According to Archer (1983) twelve (12) main steps and stages for undertaking a typical land readjustment projects can be listed as: identification of the group of adjoining landholdings for pooling which is then designated as the land pooling area; assessment of the value of each landholding in order to calculate each landowner's share in the project; preparation of a draft pooling scheme (and supporting financial plan) in consultation with the landowners and the relevant government authorities (the highway, public utility, etc. authorities) and public exhibition, review and amendment of the draft scheme followed by central government approval of the final scheme and its publication. Others steps are preparation of engineering works designs; compulsory acquisition and consolidation of the landholdings, roads, etc. in the designated pooling area; raising of short-term loan for working capital; carrying out of land servicing and subdivision works by contractors and relevant government authorities; and physical and legal subdivision of land into streets, parkland and sites for buildings. Finally there has to be the sale of some of the building sites to recover costs and repay the loan, distribution of the other sites to the landowners; and final cash adjustments to achieve each landowner's precise share of the project.

This is a land management technique where by a group of neighbouring landowners in an urban fringe area are combined with in a compulsory partnership for the unified planning, servicing and subdivision of their land with the project costs and benefits being shared between the land owners. The technique is also used to convert rural land to urban land in urban fringe areas and for urban infill areas for building land. It can be used for urban redevelopment but such projects are costly, complicated and slow. Japan for example has successfully used this technique to redevelop many of its urban areas after calamities such as earthquakes while in Bangkok, Thailand the concept has been used in resolution of slum eviction conflicts. In the latter case slum dwellers faced with imminent eviction organised and bargained for a share of the land with landlords who agreed to sell or lease them the land (Shlomo and Boonyabancha, 1988). Each project requires skilful preparation and implementation as show in a Taiwanese case in Figure 1 below.

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Land Pooling/Readjustment Project by the Kaohsiung City Government, Taiwan

Pattern of separate landholdings before pooling (After Archer, 1983)

Pattern after pooling/readjustment- including new street layout, parkland, and sites for city expansion Kaohsiung City, Taiwan

The conditions necessary for success are that the majority of the landowners support each project and the public agency is able and willing to use the power of compulsory acquisition or purchase against any minority of holdout landowners in the designated project areas. The preparation of every project involves publication of a scheme for the project, comprising plans, schedules, programmes, assessments and written statement. The scheme designs, explains and justifies the proposed project to the landowners, to the Land Readjustment agency, to central government and to the loan finance agency. When approved the scheme then authorizes and guides the agency in implementing the project. Each project is in effect a partnership of the landowners for the unified servicing and subdivision of their land and the scheme can be seen as their partnership agreement for the project. Landowner sharing of costs and benefits (increased land values) is based on their land contribution to the project.

Archer (1983) lists the following as key to the success of a land readjustment project: the relevant local government (or other government pooling agency) is genuinely interested in achieving orderly urban development to a planned pattern of urban land use; the ownership of the urban-fringe lands is fragmented into numerous separate holdings; the urban-fringe lands are ripe for urban development with the utility network mains nearby and a market demand for serviced sites for building development; a majority of the landowners in a proposed pooling area understand and support the use of pooling and that central government has set up machinery to authorise and regulate the preparation and implementation of pooling projects.

The calculation of each landowner's share can be based on the area of his/her land parcel as a proportion of the total land area or based on the estimated market value of his/her land as a proportion of the estimated market value of the total area. Any building improvements are excluded as they are either returned to the landowner or paid for with cash

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compensation if demolished. The land area basis is simple and visible but it does not recognize the differences in land quality, accessibility and value among the new building plots. The land value is more realistic and equitable but it requires the services of skilled land values/appraisers, which may not be available. In Japan and Taiwan a formula is based on land area which is adjusted by weightings in order to recognize land quantity, location and land use differentials. Partial land subdivision can also be undertaken to convert rural land or rural-urban fringe areas into parcels of subdivision land each with a frontage and public utility connections. The technique also requires that a Land Readjustment implementation agency is established to implement specific laws and regulations and set out the principles and procedures to be followed during preparation and implementation of such projects. Local governments are the preferred agency although in an integrated way they may work closely with highway authorities like the Road Development Agency, urban planning and development authorities and public housing agencies like the National Housing Authority (NHA) in Zambia. Groups of landowners can also be authorized to form cooperatives and implement land readjustment projects with guidance from public agencies.

Local governments undertake these projects mainly to obtain land development benefits which include land assembly for project sites, government acquisition of land, construction of network infrastructure, official plan implementation and landowner sharing of project costs and land values and these benefits make land readjustment a valuable technique for transfer to developing countries like Zambia. Since many of the cities have between 50-70 per cent of the population living in slums or squatter housing settlements there is also need to provide low cost housing so as to enable low income households to gain access to better housing. Two outstanding project proposals in which the concept can be applied in Zambia are the Chibolya Urban Renewal project (JICA, 2009) and the Msisi-Kuku Urban Redevelopment project (NHA, 2008). The technique can also be used to manage rapid urban growth through expansion, planned and managed urban extensions, infill and densification thereby supporting sustainable urban development. It can help public agencies tackle the challenges of urbanization, urban sprawl and slums through rights based approaches where participation and inclusiveness and managing public and private sector roles and responsibilities in urban development are key success factors.

According to UN Habitat (2013), the technique brings together landowners in a partnership for voluntary land contribution or sharing, joint spatial planning and the servicing of adjoining plots. It includes an equitable sharing of costs and benefits of projects among public agencies, landowners and developers. The surrender of land for infrastructure, low cost housing and other public space needs, and for sale to offset infrastructure costs, is a key characteristic of land readjustment. Landowners also benefit as land readjustment improves the overall individual and neighbourhood property values. For local and municipal governments land readjustment can facilitate the efficient urbanization of land at reduced costs because the project site and infrastructure rights of way do not have to be purchased or compulsorily acquired and development costs can in some cases be substantially provided from within the project. Land readjustment can provide serviced land to reduce the impact of informal settlements. Through land value sharing it can offer new public and private sector approaches to help finance infrastructure and share the benefits and burdens of development. It also creates a process that values local dynamics and supports local

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social and business networks, local culture and heritage and thus helps generate greater community support for urban development. Land readjustment enhances overall urban liveability and sustainability through the positive legacy of infrastructure built and the inclusive processes that are undertaken as part of the process.

Land readjustment has the potential benefit of constructing bulk (network) infrastructure at no cost to the government and to increase the supply of land for low cost housing in cities of developing countries. By consolidating, servicing and subdividing rural or urban land into building plots the market value of the land is increased which is then used to recover the cost of constructing roads, drains and public utility networks and to give the landowners a land value profit. The technique therefore provides local governments with land for public roads, on-site network infrastructure and open spaces free of charge. Although these benefits are well established and seen land readjustment is not seen as a potential source of land for low cost housing as they are seen as producing high cost building plots to benefit local government and land owners. However some of these plots can be allocated for low cost housing but being high value plots they will usually have to be used for multi-unit housing such as row housing, apartments/flats and rooms rather than plots for single houses that can be built by individual developers. This multi-unit low cost housing can be built outside as readymade housing for sale and rental to low income households.

4. Land Readjustment: its Limitations

Despite its many benefits, conventional land readjustment approaches have their own limitations. Müller-Jökel (2004) observes that many countries use classic instruments like compulsory purchase or expropriation for urban development. But those instruments often cause the resistance of the landowners who do not want to lose their plots. Controversial negotiations, irregular demands on compensation as well as longsome court proceedings can follow. Those effects might cause an extreme delay in realisation of sustainable urban development. It has mainly been treated as a technical tool relying on strong legal and land administration and management systems (e.g. cadastre, valuation and land markets) which result in top down design and implementation processes and which are not readily applicable in developing countries where such systems are not fully developed. The absence of comparable legal and land systems and the need to focus on achieving affordable, pro poor and inclusive outcomes as foundations of sustainable urban development has meant that land readjustment has had limited success in developing countries like Zambia. The approach requires the involvement of a varied range of specialists with expertise in areas of local governance, urban law, urban planning, land administration, politics and community engagement as well as in depth knowledge of the local context and community participation. This can be very difficult to achieve in developing contexts like Zambia. Conventional land readjustment often does not include all stakeholders at the core of its development processes and in delivering sustainable and inclusive outcomes. Ideally there should be engagement and participation especially of the poor and marginalized and of recognizing particular vulnerabilities such as gender, youth and age.

There are significant barriers to adoption of the technique by both central and local governments, so that there has slow adoption in developing countries despite its major

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contribution to urban development in other countries. Although it is politically, financially and administratively feasible it does require cadastral information, capable land valuation, project management and availability of credit finance. It is a land development technique that only produces urban building land that may take many years to be built on and occupied, whereas government objective is to achieve early building development so that the new urban areas with their costly infrastructure can be occupied and used. This partly because of the time consuming negotiations and re-plotting plan revisions that are usually necessary to gain the landowners' acceptance and support for the project. The projects may take from two to eight years to complete, for example in Taiwan and Japan respectively. The transfer of most of the building plots back to the rural landowners does not facilitate early building construction. In fact landowners many become speculators and withhold many of their plots from sale and building for years. The technique is oriented to producing higher value building plots rather than cheap plots because both the landowners and Land Readjustment agency are oriented towards higher value plots. The landowners naturally prefer to obtain larger land value gains while the agency aims for higher land values so as both to recover the project costs and to provide the landowners with significant land gains to elicit their cooperation.

5. Case Studies

Land readjustment projects carried out in Asian countries have produced significant amounts of land for housing development and facilitated the provision of bulk infrastructure. In these projects prevailing market land values were accepted and were used to achieve project cost recovery plus a significant net land value gain for landowners. Some of the plots have been allocated to public housing agencies for construction of multi-unit housing for sale and rent, some to low income households. Key lessons can be learnt from Japan, South Korea, Indonesia and Nepal for possible replication in Zambia

In Japan there has been increasing use of Land Readjustment since the last century and by 1995 some 10, 254 projects covering a total land area of 358, 230 Ha had been undertaken under the City Planning Law, 1919 and Land Readjustment comprising 20 per cent of the urbanised area of Japan. Local governments are the main agencies (40 per cent of the area), followed by landowner cooperative associations (35 per cent), and central government agencies including the public housing agency (18 per cent). Most of the projects have been undertaken in urban fringe areas as "sprawl prevention" projects and new town projects to convert rural land to building (about 20 per cent of the 358, 230 Ha) land but some were urban renewal and town centre infrastructure projects. This successful use of land readjustment has been due to the need for reconstruction after war and earthquakes but also due to availability of central government grants to finance the cost of infrastructure (Archer, 1999).

In South Korea nearly all Land Readjustment projects are undertaken by local governments which have made extensive use of the technique to construct network infrastructure and produce plots for housing and other developments. During 1962-81 period land readjustment accounted for 95 per cent of the total supply of urban land. In 1980 central government took over responsibility for supply of housing land and commenced a large scale national programme of land acquisition and subdivision by the Korea Land Development Corporation

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and Korea National Housing Corporation. Since 1995 local governments have been given a greater role in land development again.

In Seoul 132.6 Ha urban land where produced in the 1950s; 5,912.3 ha in the 1960s, 3, 990.8 ha in the 1970s and 1,442.1 ha in the 1980s through a total of 41 Land Readjustment projects. Another 808 ha of urban land were produced by the Korea National Housing Corporation and Landowner groups. The City government mainly undertook its projects to construct network infrastructure and to produce plots for housing with full cost recovery by sale of some plots at market value. In 1974 it began selling some cost recovery plots at concessional prices to the National Housing Corporation and local municipalities for construction of multi-unit housing for low income housing. The sale of plots at concessional prices were cross-subsidised by the sale of additional cost recovery plots at full market prices and this increased the available plots from 11 to 15 per cent before 1974 up to 21-35 per cent in later projects (ibid, 1999).

In Indonesia the first Land Readjustment project commenced in 1981 by the Bali Provincial Office and by August 1995 some 132 projects covering 8,300 ha had been undertaken in 25 provinces. The projects were undertaken by to convert rural land in urban fringe areas into layouts of public roads and drains, reshaped land parcels with registered land titles and public facility sites. The roads, drains, water supply and electricity lines were constructed later by the local government and public utility agencies as land parcels were gradually brought into housing development and funds made available. Most of the land was sold as plots for middle and high cost housing but some landowners constructed rental rooms and apartments on part of their land (ibid, 1999).

In Nepal three Land Readjustment projects were undertaken in the provincial town of Pokhara during 1975-83 period so as to acquire the land for two main roads and a bus station and to finance the construction of roads. No further projects have since been undertaken in Pokhara but 14 similar projects have since been implemented in the Kathmandu Valley and in Dhulikhel. Between 1989 and mid 1997 five projects covering 80.6 ha had been completed. The other nine projects covering a total of 498.3 ha were implemented. All but one project were undertaken by the Kathmandu Valley Town Development Committee and its subsidiary town development committees while others were implemented by the local government. All projects provide land for housing (ibid, 1999).

A participatory land readjustment pilot implemented in Medellin, Colombia has shown that Land Readjustment can be used as a tool for urban densification and delivering serviced land in an equitable manner. It incorporated urban governance, land legislation, public private partnerships and community in demonstrating how the technique can be used to achieve sustainable urban development at scale through improved planning (mixed use neighbourhoods with adequate public space) and infrastructure and appropriate density). Local dynamics such as community networks, heritage, culture and local businesses were also identified as a means to maintaining the core positive local dimensions of a place with the change process. Stakeholder participation was also developed at other levels including effective engagement of land owners, civil society, academia and public and private sector property developers as well as financial institutions (UN Habitat, 2013).

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7.0 Conclusion

In light of the urbanisation challenges, rapid growth of urban population and high demand and short supply for urban land, the land readjustment technique can effectively help to address some of the problems of lack of serviced land, and the provision bulk infrastructure and inadequate housing. Clearly the benefits surpass the limitations and the lengthy procedure can be overcome by selling many of the landowners' plots and paying the proceeds to them. Alternatively a building development covenant can be appended to the title of each plot requiring building construction to commence within a specified time period, failing which the appointed agency has the right to repurchase the plot at its assessed value.

Rural landowners should be encouraged to become investors instead of speculators by selling their plots and constructing low cost rental housing on their remaining plots. This can provide them with an urban livelihood as well as increasing the supply of affordable rental housing. Although the focus of the land readjustment is on high land values such projects provide a greater opportunity to allocate some of the new plots at cost or below cost to low cost housing. But being high value plots the land can only be used for multi-housing unit rather than single housing units. Public housing agencies and non-profit groups can also purchase land parcels so as to participate as landowner partners thereby obtain plots for multi-unit low cost housing at the cost of rural land parcels plus interest on funds utilized.

Land Readjustment is possible in Zambia where private developers are undertaking rural or urban land subdivision as a business activity. The procedure should include participatory and inclusive priorities within the context of developing appropriate governance, legislative and regular mechanisms to better facilitate planning, participation and land value sharing or land value capture with the aim of delivering a sustainable dynamic and inclusive redevelopment. Early and consistent but realistic stakeholder participation is required to encourage community input and ultimate ownership of the urban redevelopment process. Finally the adoption of the technique requires the enactment of a Land Readjustment law and greater central government role to administer, authorize, regulate and provide oversight and to promote and assist public agencies to adopt the technique in Zambia.

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SWOT ANALYSIS AS A MEANS FOR IDENTIFICATION OF INFRASTRUCTURE DELIVERY OBJECTIVES DRIVEN BY MONETARY INCENTIVES

Ruben Ndihokubwayo[1], Gerrit Jacobus Crafford[2], Fanie Buys[3]

Abstract

While the targeted procurement of projects in infrastructure delivery has been suggested as an efficient strategy for addressing socio-economic objectives in South Africa; no strength, weaknesses, opportunities, and threats (SWOT) analysis have so far been utilised to evaluate the importance of offering monetary incentives to achieve infrastructure delivery objectives. The purpose of this paper is to ascertain which project objectives can or cannot be achieved through the provision of monetary incentives to construction and consultant team members. A web survey was adopted by using a questionnaire nationwide to purposively selected participants including contractors, quantity surveyors, project managers, architects, and consulting engineers requesting them to base their responses to a specific construction project they have been involved in. In total, 164 construction industry stakeholders participated in the survey. A quantitative data analysis was adopted and data was analysed using Principal Component Analysis (PCA) on project objectives aligned with monetary incentives. The PCA output generated a 'component plot in rotated space' quadrant which was then accustomed for SWOT analysis. Findings revealed that secondary project objectives such the provision of work opportunities to SMMEs, health and safety , skills transfer, poverty alleviation, and gender and racial equality have a positive effect as they constitute a 'strength' on project success if aligned with monetary incentives. It was concluded that the lack of monetary incentives towards performing secondary project objectives may lead to dropping from strengths to threats.

Keywords: Infrastructure delivery objectives, monetary incentives, SWOT analysis.

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1. Introduction

Infrastructure delivery has become one of key indicators of socio-economic growth for any country. Typically, in developing countries like South Africa, infrastructure development plays a pivotal role in addressing socio-economic targets. The alignment of infrastructure delivery objectives with motivational incentives can address South African socio-economic challenges. Watermeyer, Gounden, Letchmiah, and Shezi (1998:15) advise that the construction and procurement strategies as intervention measures can address social and economic concerns and, depending upon how they are structured, can be utilised to facilitate the economic empowerment of marginalised sectors of society, and to address unemployment in a focused manner. Both primary and secondary objectives can be set in infrastructure delivery. Primary objectives such as cost, time, and quality are those related to direct activities of which involved parties are naturally so eager to fulfil. Secondary objectives are those in relation with intervention measures tailored to address certain socio-economic problems. The most commonly encountered secondary objectives in the South African construction industry relate to the following themes (CIDB, 2004a:2): business empowerment; job creation; development of small, medium and micro enterprise sectors; poverty alleviation; community based developments and local economic development. This can be possible through targeted procurement strategies to address specific socio-economic objectives. It is obvious that the government has put in place enabling policies towards the achievement of project objectives; however, no strength, weaknesses, opportunities, threats (SWOT) analysis have so far been utilised to evaluate the importance of offering monetary incentives to achieve infrastructure delivery objectives. The objective of this study is to ascertain which project objectives can or cannot be achieved through the provision of monetary incentives to construction and consultant team members.

2. SWOT analysis

A SWOT analysis is a strategic balance sheet of an organization; that is the strengths of the organization, the weaknesses of the organization, the opportunities facing the organization, and the threats facing the organization (Lusier, 2003; Williams, 2010). Robbins and Decenzo (2004) emphases that SWOT analysis refers to analysing the organisation's internal strengths and weaknesses as well external opportunities and threats in order to identify a niche that the organisation can exploit. In the context of the study, SWOT is used to evaluate at what extend the provision of monetary incentives is successful in achieving infrastructure delivery objectives.

Opportunities: Need for improvement	**Strengths:** Standards to be maintained
Weaknesses: Not regarded as a priority	**Threats:** May become counterproductive

Figure 1 SWOT analysis quadrants (Own figure)

Figure 1 depicts SWOT quadrants in which 'strengths quadrant' suggests that the provision of monetary incentives is recommended in order to achieve infrastructure delivery objectives.

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'Opportunities quadrant' suggests a need for improvement in the provision of monetary incentives towards achieving infrastructure delivery objectives. 'Weakness quadrant' suggests objectives falling there cannot be prioritised when offering monetary incentives. 'Threat quadrant' suggests the provision of incentive may not generate any positive outcome. Kvaløy, Nieken and Schöttner (2013) indicate that monetary incentives do not always improve performance. However, it not obvious which objectives may be achieved when using monetary incentives and those one cannot be achieved.

3. Government policies enabling setting project objectives aligned with monetary incentives

3.1 Targeted procurement strategies

Since 1994 government embarked upon a comprehensive programme to provide a legislative framework for the transformation of our economy (DTI, 2003). DTI (2003) indicates that new laws have restored rights to land and tenure; have prescribed unfair discrimination; and, introduced specific active measures to overcome the distortions in the labour market as well as provide new economic opportunities to historically disadvantaged persons. In 1997, the government issued a Green Paper on public sector procurement reform (DTI, 2003). This policy document recognised that the government, as the largest buyer of goods and services in the economy, had the responsibility to leverage this purchasing power in support of its economic policy objectives of Broad-Based Black Economic Empowerment (BBBEE), small enterprise development, and labour-intensive construction (DTI, 2003). This suggests that the government supports the promotion of BBBEE in making resources available and the implementation is done in both local and government departments, typically by introducing incentives in construction projects.

The BBBEE Act was passed in 2003 and signed by the President in 2004. The Government Gazette (2004) refers the BBBEE to as the economic empowerment of 'black people' – a generic term meaning Africans, Coloured and Indians – which includes women, workers, youth, people with disabilities and people living in rural areas, through diverse but integrated socio-economic strategies that include, but are not limited to:

- Increasing the number of black people that manage, own and control enterprises and productive assets;
- Facilitating ownership and management of enterprises and productive assets by communities, workers, cooperatives and other collective enterprises;
- Human resource and skills development;
- Achieving equitable representation in all occupational categories and levels in the workforce; and
- Preferential procurement and investment in enterprises that are owned or managed by black people.

The targeted procurement enables the organs of state to operationalise policies in a targeted, transparent, visible and measurable manner when engaging in economic activity with the private sector, without compromising principles such as fairness, transparency, competition, cost-efficiency and equitability (Watermeyer *et al.* 1998:15). In this regard, CIDB (2004b:1) points out that Section 217 (3) of the Constitution requires that national legislation must prescribe a framework within which the preferential procurement policy must be implemented.

3.2 Need for setting objectives as performance measure

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In order to successfully achieve infrastructure delivery objectives, goals should be set in advance serve as a performance measure against success. In the infrastructure delivery context, these goals can be understood as development needs which compel clients to initiate a project. Rougvie (1987) postulates that these needs may be seen as a function of the motives of different agencies who wish to develop themselves, or to use the products of development. Agencies may be understood as clients and these vary in many ways. Walker (2002) indicates that the variety of clients is premised on objectives they seek to satisfy.

Walker (2002) establishes that the most important feature of any building project should be the client's objectives. It is imperative that project objectives should be defined at the earliest stage of the project. Walker (2002) recommends that the client's objectives should be clearly stated and clearly transmitted to the contributors of the project. Van der Waldt and Knipe (1998) stipulate that project needs should be determined at the project preparation phase. Walker (2002) indicates that the need for the project should rise from some demand arising from the client's organisation's primary activity. Oberlender (1993) advises that clients must know their objectives before any productive project work can be started. Lavender (1996) indicates that when the client is satisfied that there is a need for a project, the next stage is to undertake the necessary feasibility studies to ascertain whether the proposed project will meet the objectives of the client.

4. Methodology

The Principal component analysis (PCA) was done to generate a 'total variance explained', 'component score covariance matrix', 'rotated component and component score coefficient matrices' and 'component plot in rotated space' which formed a basis for customisation of PCA results to SWOT analysis. Abdi and Williams (2010) refer to PCA as a multivariate technique that analyses a data table in which observations are described by several inter-correlated quantitative dependent variables. PCA is appropriate when one has obtained measures on a number of observed variables and wishes to develop a smaller number of artificial variables that would account for most of the variance in the observed variables (SAS, 2011). Fellows and Liu (2008) stipulate that the principal components are extracted so that the first principal components account for the largest amount of the total variation in the data. Since the distinctive characteristic of principal components analysis is its data-reduction capacity, it must determine the number of factors to be retained (Fellows & Liu, 2008). However, for the purpose of the study, PCA results have been further traslated in a strengths, weakenesses, opportunities, and threats (SWOT) analysis quadrant as indicated in Figure 1. Jeyaraj, Muralidharan, Senthilvelan, and Deshmukh (2012) indicate that companies conduct the SWOT analyis as part of their strategic planning before formulation of their long and short term strategy. A methodological approach where SWOT and PCA were combined has been used in a case study by Jeyaraj *et al.* (2012) to analyse the short and long range strategy for a textile processing organisation in India. For the purpose of the current study, Principal Component Analysis (PCA) was done on project objectives aligned with monetary incentives. The output generated 'component plot in rotated space' quadrants which were accustomed for SWOT analysis.

A web survey strategy was used to gather the empirical data whereby a questionnaire was distributed nationwide. The quantitative approach was adopted whereby questionnaire survey was designed with closed-ended questions grouped into two sections. Section A requested the biographic profile of respondents. Section B concerned the importance of incentives offered towards the achievement of project objectives. Respondents were able to indicate on a 7 point Likert-scale how important monetary incentives offered towards the achievement of project objectives. In all instances where the Likert response format questions were used, the scale measurement was 1 = unimportant , 2 = little important, 3 =

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somewhat important, 4 = important, 5 = very important, 6 = extremely important, 7 = utmost important, and U = Unsure.

One hundred and sixty four (164) construction members of the Engineering Council of South Africa (ECSA), South African Institute of Architects (SAIA), South African Council for the Quantity Surveying Profession (SACQSP), South African Council for Project and Construction Management Profession (SACPCMP), and general building contractors registered by the Construction Industry Development Board (CIDB) completed and returned the questionnaire.

Likert-type or frequency scales use fixed choice response formats and are designed to measure attitudes or opinion levels of agreement/disagreement (Bowling 1997). Using a 7 point Likert response format allows the respondents more granularity and hence better decision-making to express how much they agree or disagree with a particular statement. When using Likert-type scales it is imperative to calculate and report Cronbach's alpha coefficient for internal consistency reliability for any scales or subscales one may be using (Gliem, & Gliem, 2003). Reliability is the extent to which a measuring instrument is repeatable and consistent (Maree & Pietersen, 2007). For this particular paper, the internal reliability of variables was tested by using Cronbach's alpha coefficient of reliability. Maree and Pietersen (2007) suggest the guidelines for the interpretation of Cronbach's alpha coefficient as follows: 0.90 – high reliability, 0.80 – moderate reliability and 0.70 – low reliability. Table 1 reports the reliability of monetary incentives aligned with project objectives. It is evident the study produced highly reliable measures ranging from 0.94 to 0.99.

Table 1 Test of reliability of monetary incentives towards achieving project objectives

Project objectives	No. of items	Monetary incentives	
		Cronbach's alpha	Comments
Cost	13	0.97	Highly reliable
Time	11	0.97	Highly reliable
Quality	15	0.99	Highly reliable
Gender & racial equality	8	0.98	Highly reliable
Provision of work opportunities to SMMEs	5	0.95	Highly reliable
Poverty alleviation	10	0.98	Highly reliable
Skills transfer	7	0.94	Highly reliable
Health (HIV/AIDS) & safety	7	0.98	Highly reliable

5. Findings

5.1 Profile of respondents

From Table 2, it is evident that out of 7,629 delivered e-mails to respondents; only 178 responded using the web survey and their responses were subsequently downloaded in Microsoft Excel. In order to avoid any duplication, responses were further screened; thus, 144 respondents were retained and 34 were cancelled. The criterion for identification of a duplicated response was: similar responses throughout on two or more consecutive rows, and same date of submission. Other 20 respondents preferred to complete the questionnaire on a soft copy, thus the total number of respondents was 164; hence the research participation was 2.1%. Reasons for not participating included retirement, too busy with work, technical problem with internet. Missing data was not reported in tables and charts.

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Table 2 Targeted population

Population	Sent	Not delivered	Delivered
Architects	1,730	442	**1,288**
Architectural technologists	1,372	300	**1,072**
Architectural draughtsperson	747	153	**594**
Consulting engineer	466	122	**344**
Project/construction managers	2,825	558	**2,267**
Quantity surveyors	719	215	**504**
Contractor, Grade 3	529	197	**332**
Contractor, Grade 4	802	310	**492**
Contractor, Grade 5	431	142	**289**
Contractor, Grade 6	467	238	**229**
Contractor, Grade 7	197	54	**143**
Contractor, Grade 8	80	25	**55**
Contractor, Grade 9	29	9	**20**
Total	10,394	2,765	**7,629**
Percentage	**100**	**26.6**	**73.4**

Figure 2 shows that 73.2% (120) of respondents had experience in the construction industry over 10 years, 22.0% (36) between 5 to 10 years and 4.9% (8) less than 5 years. 42.1% (69) of respondents had been in their current position over 10 years, 31.1% (51) between 5 to 10 years and 26.8% (44) less than 5 years.

Table 3 Participant companies

Company	No.	%	
Contractor Grade 2	1	0.6	27.8
Contractor Grade 3	7	4.3	
Contractor Grade 4	5	3.1	
Contractor Grade 5	7	4.3	
Contractor Grade 6	8	4.9	
Contractor Grade 7	9	5.6	
Contractor Grade 9	9	5.6	
Project Manager	32	19.8	
Architect	27	16.7	
Quantity Surveyor	27	16.7	
Consulting Engineer	13	8.0	
Government	4	2.4	
Academic	3	1.9	
Agent	2	1.2	
Construction Consultant/Developer	2	1.2	
Engineering	2	1.2	
Logistics	2	1.2	
Property Consultant	2	1.2	
Parastatal	1	0.6	
Construction Regulatory	1	0.6	
Total	162	100.0	

Table 3 shows that participant companies included mostly contractors (27.8%), project managers (19.8%), architects (16.7%), quantity surveyors (16.7%), consulting engineers (8.0%). There were 2 missing values which were not reported in the Table.

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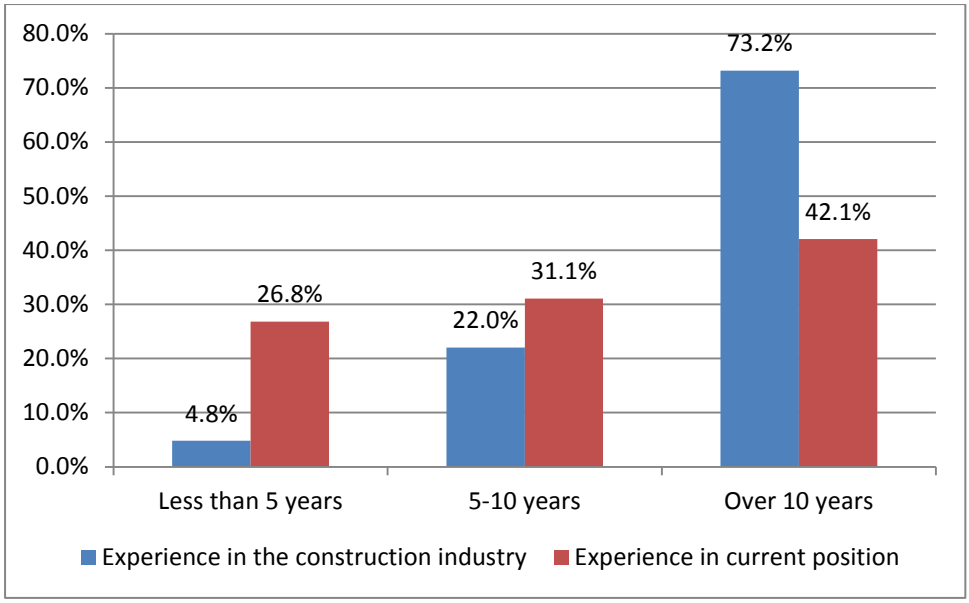

Figure 2 Experience of respondents

5.2 Principle component analysis (PCA) for project objectives aligned with monetary incentives

The importance of monetary incentives aligned with 8 project objectives in terms of their achievement of project success were subjected to principal component analysis using SPSS version 21.

Table 4 Kaiser-Meyer-Oklin Measure and Bartlett's Test

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy		0.88
Bartlett's Test of Sphericity	Approx. Chi-Square	709.34
	Df	28.00
	Sig.	0.00

The Kaiser-Mayer-Oklin value in Table 4 was 0.88 and the Bartlett's Test of Sphericity reached a statistical significance (0.00), supporting the factorability of the colleration matrix. The principal component analysis as shown in Table 5 revealed the presence of two components with eigenvalues exceeding 1, explaning 57.90%, and 15.52% of the variance respectively.

A further analysis with a two-component solution explained a total of 73.42% of the variance, with Component 1 contributing 57.90% and Component 2 contributing 15.52%. To aid the interpratation of these two components, the varimax rotation was performed in Table 6. Varimax rotation was proposed given that it was assumed that the variables are not correlated. This is confirmed by the value of the covariance which was 0.00, meaning two variables were independent of each other, thus the value of one does not provide any assistance in predicting the value of the other. The communalities output in Table 7 showed that all values were above 0.3, Skills displaying the lowest value of 0.63. This confirms there was no need for refining the scale (Pallant, 2010).

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Table 5 Total variance explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	4.63	57.90	57.90	4.63	57.90	57.90	3.22	40.24	40.242
2	1.24	15.52	73.42	1.24	15.52	73.42	2.65	33.18	73.418
3	0.56	7.00	80.42						
4	0.47	5.81	86.23						
5	0.39	4.87	91.11						
6	0.33	4.11	95.22						
7	0.25	3.09	98.31						
8	0.13	1.69	100.00						

Table 6 Component score covariance matrix

Component	1	2
1	1.00	0.00
2	0.00	1.00

Table 7 Rotated component and component score coefficient matrices

Component	Rotated component matrix		Component Score Coefficient Matrix		Communalities
	Component		Component		
	1	2	1	2	Extracted
SMMEs	0.82		0.31	-0.10	0.74
Health	0.79		0.31	-0.13	0.66
Skills	0.78		0.30	-0.12	0.63
Poverty	0.77		0.27	-0.06	0.68
Gender	0.68	0.31	0.22	-0.02	0.56
Time		0.91	-0.14	0.43	0.90
Cost		0.89	-0.17	0.44	0.83
Quality	0.38	0.85	-0.07	0.37	0.87

5.3 **Customisation of "component plot in rotated space" PCA output to SWOT analysis quadrant**

The results of the PCA output from component plot in a roted space (Figure 3) are analysed from the importance-success quadrants interpreted as follows:

- Bottom right: items falling under this quadrant indicate strengths but facing greater threat threats than opportunities (Chang & Huang, 2006). In context of the study, either the lack or excessive incentive may compromise with the optimum achievment of project objectives.
- Bottom left: items falling under this quadrant indicate low strengths and face threats (Chang & Huang, 2006). In the context of the study, threats to achieve a project objective may be eliminated if incentives could be set as a priority towards higher performance.

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- Top left: items falling under this quadrant indicate developing opportunities (Chang & Huang, 2006). In the context of the study, the achievement of a project objective may be improved by providing incentives.
- Top right: items falling under this quadrant indicate sufficient strengths to adopt developmental strategies and opportunities(Chang & Huang, 2006). In context of the study, project objectives meet required standards and they have to be maintained and sustained through the provision of incentives.

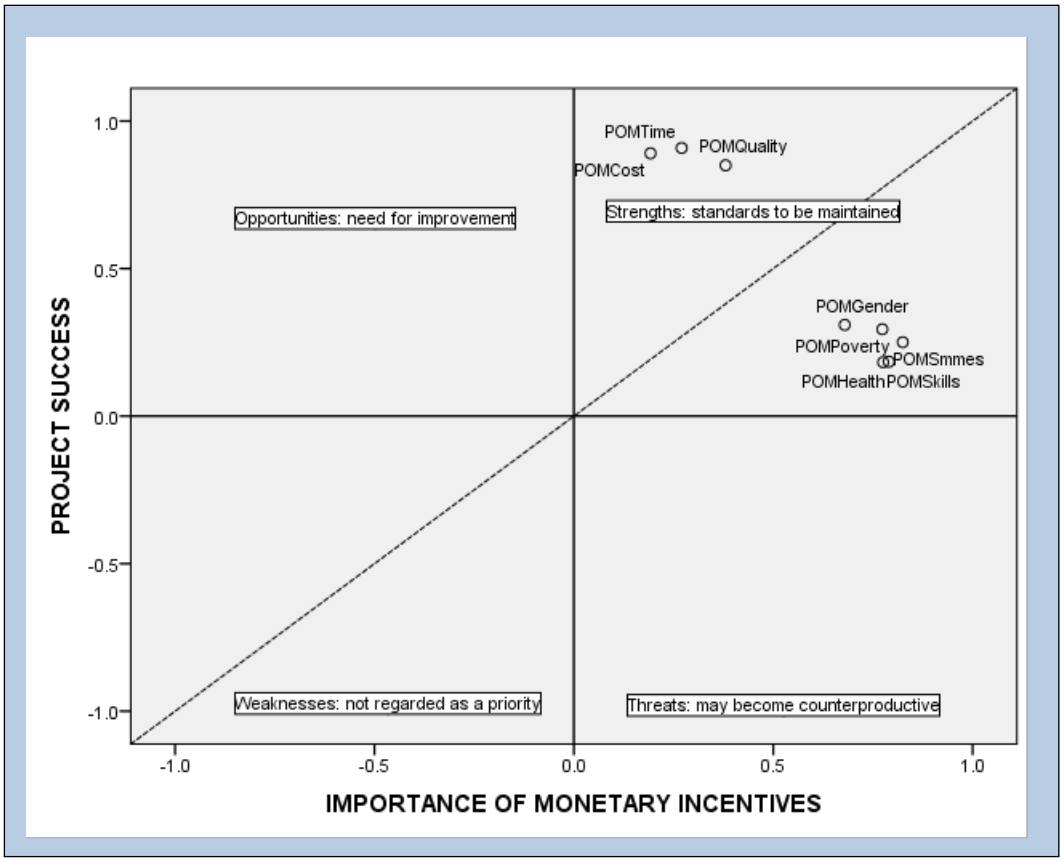

Figure 3 Component plot in rotated space

From Table 7 the rotated solution converging in 3 iterations revealed that Component 1 items such as provision of work opportunities to SMMEs, health (HIV/AIDS) and safety , skills transfer, poverty alleviation, and gender and racial equality have a positive effect (positive component coefficients) on project success if aligned with monetary incentives. However, Component 2 items such as cost, time, and quality have a negative effect (negative component coefficients) on project success if aligned with monetary incentives. This suggests monetary incentives have little importance of motivating construction and consultant team members to achieve cost, time and quality targets. From Figure 3, It is evident that required standards are met for both primary and secondary project objectives; however, the lack of monetary incentives towards performing secondary project objectives may lead to dropping from strengths to threats.

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6. Conclusions

The study confirms the suitability of monetary incentives to achieve secondary project objectives in infrastructure delivery projects. From PCA output, it should be concluded that the provision of work opportunities to SMMEs to be prioritised and the provision of monetary incentives would yield positive results. This is in line with the provision of BEEE agenda. It is therefore important to implement a procurement system having monetary incentive provision in contractual conditions. The CIDB (2010) indicates that the development of a procurement strategy should consist of the identification of the best way of achieving objectives and value for money, whilst taking into account risks and constraints. Similarly, appropriate motivational incentives may be incorporated in contractual conditions so as to achieve specific project objectives. When planning the provision of incentives, the following questions should be answered along the process:

- Will incentive be required to satisfy this project objective?
- If yes, which types of incentive are available?
- Which project team members would require incentives, and are their demographics influenced by incentives?
- Which mechanisms are available to implement the provision of incentives

7. Recommendations

Findings confirm the provision of monetary incentives towards achievement of secondary project objectives is at its full strengths. Standards should therefore be maintained to avoid falling from strengths to threats. Further studies should explore the suitability of non-monetary incentives towards the achievement of project objectives.

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VALUE FOR MONEY IN INTERNATIONAL INFRASTRUCTURE PUBLIC PRIVATE PARTNERSHIP POLICIES: SURVEY OF AFRICAN STATES

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Abstract

The international evidence suggests that public private partnership (PPP) procurement methods using value for money evaluation criteria are delivering better infrastructure services at lower cost than traditional procurement methods. Central to the operation of public private partnerships is the systematic evaluation of the procurement options available to government, as well as an output specification to encourage private design, risk transfer, construction and operational innovation, the detailed analysis of projects over their operational life cycle, a rigorous and competitive bid process, and the selection of proposals that deliver value for money. Value for money is a measure that takes into account both the quantitative and qualitative outcomes over the term of a contract. International surveys undertaken for this study suggest that public private partnership policies that adopt value for money principles and practices will provide government with more accurate information to configure optimal procurement solutions for infrastructure service delivery.

Among non-member Organisations for Economic Co-operation and Development (OECD) countries, practices vary and value for money assessment may use a formal assessment method such as the public sector comparator or one of several informal methods such as a requirement for detailed project analysis during the investment stage, technical service specifications, detailed bidder selection criteria, special approval and governance standards, the prequalification of bidders, and a requirement for competitive bidding, standard commercial principles or competitive dialogue during negotiations. A review of the international evidence suggests PPPs that use value for money evaluation criteria are achieving improved procurement outcomes for government. This is more prevalent with larger and more complex projects that make greater use of risk transfer, innovation, technology, and a competitive bid market. International evidence suggests that PPPs are lowering the cost of services to government, improving regional economic performance, and are making a significant contribution to improved service quality.

Keywords: Infrastructure, public private partnerships, international survey.

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1.0 Introduction

Many countries specify *value for money* (VfM) as part of project selection and bidder evaluation criteria although not all provide detailed methodology for measuring it. Grimsey (2006) suggests that there are four methods for determining VfM in project procurement:

- A full cost-benefit analysis of the most likely public and private sector alternatives.
- A detailed modelling of risk-weighted and life cycle costed models of traditional state procurement (the Public Sector Comparator - PSC) and a shadow bid for a PPP before bids are invited.
- A VfM comparison of the PSC and the contractor proposals received following the tender process.
- Reliance on a competitive bidding process.

A recent survey of 18 OECD countries and one sub-national government found all but one jurisdiction conducted *ex ante* VfM analysis for PPP projects (Burger and Hawkesworth, 2011). The survey included 19 national governments (Austria, Canada, Denmark, France, Germany, Hungary, Netherlands, Norway, Spain, Czech Republic, Greece, Ireland, Italy, Slovak Republic, South Africa, United Kingdom, Australia, Korea, Chile and Mexico, and one provincial government New South Wales, Australia (Burger and Hawkesworth, 2011, p. 11). The survey suggested that the manner and time at which VfM was assessed was different in most of the countries surveyed.

The two common methods for ascertaining VfM are as follows. First, a public sector comparator (PSC), which is a life cycle cost model of the most expedient alternative procurement method to a PPP, generally a traditional procurement model. The PSC is a theoretical construct based on the initial scope and specification for the service and is used to select the best procurement option (HM Treasury 2011a). In some jurisdictions, the PSC undergoes further adjustment to create a benchmark that is used to measure risk-adjusted cost differences between proposals received from private contractors in a competitive bid process (Infrastructure Australia, 2008b; HM Treasury, 2006).

2.0 The Public Sector Comparator

The PSC is a hypothetical model of government procurement using the most expedient method available to deliver services to specification over the term of the proposed PPP contract. The PSC represents the quantitative measure of VfM with an infrastructure project. It is supported by a qualitative analysis of bids received from a competitive tender process that takes place later in the procurement process.

The PSC is an estimate of the financial cost of the project over term of the proposed PPP contract. It includes the initial capital cost of constructing the infrastructure, and the operational and other expenses incurred delivering services over the project life cycle. It also provides a comparative tool for selecting the contractor bid that best meets the project requirements. In fully-developed form, the PSC is also weighted for risk. This means that the

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major cost variables over the life of the contract such as site conditions, construction cost, operating expenses, hold-ups and delays, demand for services, financing costs, compliance with environmental and service requirements, and force majeure events are taken into account when calculating the aggregate cost of delivering the service. Many of these risks will be allocated to contractors and the remainder borne by government. The risks are identified and fully priced using a number of conventional techniques, and a final adjustment made for competitive neutrality (the value of government's tax exemptions and immunities) and *ex post* regulatory and contract management costs incurred by government. The adjusted PSC is called a reference project and it permits a like-with-like comparison to be made between the two methods of procurement. Risk identification, measurement and pricing are examined in further detail below.

The design of the PSC and its use varies between jurisdictions. In the United Kingdom, an early assessment is made of financial models of the most efficient method of traditional procurement and a shadow PPP bid using a standard spread-sheet template. The shadow bid is based on historical data received from earlier bidder proposals of similar type. The agency then can determine which procurement option offers best VfM. In other jurisdictions, the PSC takes the form of a detailed options analysis or feasibility study that takes into account technical, legal, environmental and financial due diligence assessment. In different jurisdictions not all of these stages in the development of the PSC are necessarily observed. Nevertheless, the PSC used to determine VfM is a model of the most efficient method of government delivery of the service for similar assets or services.

The PSC uses discounted cash flow analysis that meets the output specification for the project. It takes into account the value of the risk withheld by government, the value of the risk transferred to the contractor and competitive neutrality, which adjusts for the tax and other exemptions that apply to government and its agencies. The PSC has several applications: it can be used to establish a project's feasibility, to prioritise a short-list of projects, and used to select a successful bidder from a competitive tender process. As a fully priced procurement option for government, it enables government agencies to identify the financial differences between procurement options. The PSC plays an important role in the evaluation of proposals and the assessment of VfM. However, its accuracy depends on the assumptions used to establish costs, i.e. to identify, measure and price risk. The PSC should be robust and consistent with the project scope issued to bidders (KPMG, 2011: p. 2). The elements of the PSC are the "base" or "raw" PSC, which is a costing of the asset or services under government ownership and management, an adjustment for competitive neutrality, the value of risk transferred to the contractor, the risk retained by government, and the discount rate.

3.0 Additional Value for Money Benefits

Alternative methods are available for assessing *ex ante* VfM with PPP projects during either the investment or the procurement stages of the project. At the investment stage, this may take the form of multi-criteria analysis, cost effectiveness studies, options analysis, and comparisons against earlier procurement benchmarks (Republic of South Africa, 1999: Treasury Regulation 16). During the procurement stage, government may require review of

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the short-listed bidder proposals by independent consultants, a systematic in-house analysis of the preferred bid, or the coordination, oversight or monitoring of projects by the PPP unit or the Treasury and Finance Department [The Philippines Build-Operate-Transfer (BOT) Law RA 7718/2012]. Each of these methods of assessing VfM is examined in the following section.

A further requirement to enhance VfM outcomes is a competitive bid process, which assumes that private contractors can generally deliver assets and services more efficiently and at lower cost than a public sector agency. The requirements here may include a minimum number of bidders, a pre-qualification process, and an open auction approach to the Expression of Interest (EOI) or Request for Proposal (RFP) stages of the bid or a two-part evaluation process whereby the technical evaluation of bids proceeds independently of the commercial evaluation. These practices are adopted with many concessions and BOT contracts and rely on a competitive bid market to enhance VfM outcomes compared with traditional procurement, which is widely accepted as the benchmark for measuring infrastructure procurement. Unlike a PPP, a traditional contract is an adversarial contract with an input specification and the contractor is selected using criteria heavily weighted in favour of lowest cost. The advantages of traditional procurement are that it is a simpler procurement process to follow and a relatively low cost procurement option for government.

The steps that can be taken during the procurement process that increase the likelihood of an improvement in VfM include a requirement for significant risk transfer (Republic of South Africa, 1999: Treasury Regulation 16), a well-drafted output specification (India Ministry of Finance, 2011), a review of the administrative and technical requirement of bids with the government's project requirements (Republic of Indonesia, 2010: Law PR13/2010), the adoption of competitive bidding with a minimum number of bidders (Indonesia Law PR13/2010), a rigorous or two-part bidding process (Government of the Philippines, 2012: BOT Law RA 7718/2012, Rule 5), separate technical and financial selection processes (India Ministry of Finance 2012; The Philippines BOT Law 2012 RA 7718/2012), observing competitive negotiations following appointment of the preferred contractor, and the use of comprehensive selection criteria. For example, India's draft national PPP policy proposes a weighting for technical assessment accounting for 70% of selection criteria. This may include qualitative factors such as the bidder's experience and track record with PPP projects.

4.0 Value for Money Measurement

There are two ways of calculating VfM with PPP procurement. The first involves the preparation of a PSC or the use of benchmarking to compare the procurement options during the investment decision-making for the project. As noted above, many OECD countries employ formal evaluation of VfM because of the information that it provides government about the value of project risk for allocation purposes, life cycle costs, and the optimal configuration of projects. This information provides government with decisions about investment, procurement and bidder selection. Formal VfM determination is examined below. VfM may also be enhanced for PPP projects with a comprehensive procurement process, competitive bid markets, and independent evaluation and approvals process.

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4.1 Formal Assessment

Formal VfM assessment generally involves the preparation of a life cycle-costed traditional procurement benchmark used to compare alternative procurement options, and following adjustment for risk transfer and competitive neutrality, it is used for the comparative assessment of contractor bids during the bidder selection process. Formal VfM assessment requires assessment of both the quantitative and qualitative characteristics of bids.

4.2 Quantitative Measurement

Quantitative measurement sets out to compare the costs and benefits of different procurement options. It may be undertaken on a formal basis using a procurement benchmark such as the PSC, or a combination of technical and financial requirements prepared by government for the project. Both methods attempt to compare the PPP procurement option against a benchmark such as a traditional design and construction solution. The choice of measurement method will be based on a number of considerations unique to the project such as the level of complexity, the size of the project, and opportunity to achieve VfM cost savings through risk transfer, private management efficiency, or design and construction efficiency.

In OECD countries, VfM is determined using a PSC, which measures the difference between a traditional procurement method and either a shadow PPP bid during the investment stage of the project or actual bids received during the procurement stage. The PSC and shadow bid can be undertaken during the investment stage of the project to inform government decision-making about the procurement method, and later to compare the preferred bidder's proposal during the procurement stage. In non-OECD countries, the selection of both the procurement method and successful bidder is made against informal criteria such as a competitive bid process or using comprehensive bid market selection criteria.

5.0 International Survey of PPP Policy

Information about international PPP policies and the role that VfM plays is determining benefits to government from this method of procurement was collected in a survey of 80 countries (OECD, 2010). The survey was used to identify the incidence of PPP policy and the use of VfM in the procurement process. A second study of 20 countries examined national PPP policy in greater detail to examine differences in the use of VfM principles between OECD and non-OECD countries. A third study used a sample of six countries for more detailed explanation of PPP policy and the application of VfM principles.

A survey of 80 countries was conducted in January 2013 to identify nations with a PPP procurement policy and the extent to which the national policy employed VfM assessment criteria. Table 1 summarises the 80 country survey and indicates whether PPPs are being pursued and whether a VfM framework is being followed.

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Table 1 Public Private Partnership Policy Survey

Country	PPP/BOT Policy	VfM Principles	Country	PPP/BOT Policy	VfM Principles
1. Algeria	Yes		44. Malta	Yes	Yes
2. Argentina	Yes		45. Mauritius	Yes	Yes
3. Australia	Yes	Yes	46. Mexico	Yes	
4. Austria	Yes		47. Mongolia	Yes	
5. Bangladesh	Yes		48. Morocco	Yes	
6. Belgium	Yes		49. Mozambique	Yes	
7. Botswana	Yes		50. Myanmar	In Progress	
8. Brazil	Yes		51. Namibia	Yes	
9. Bulgaria	Yes		52. Nepal	Yes	
10. Cambodia	In Progress		53. Netherlands	Yes	
11. Cameroon	Yes		54. New Zealand	Yes	Yes
12. Canada	Yes	Yes	55. Nigeria	Yes	
13. Chile	Yes		56. Northern Ireland	Yes	Yes
14. China	Yes		57. Norway	Yes	Yes
15. Colombia	Yes		58. PNG	In Progress	In Progress
16. Costa Rica	Yes		59. Pakistan	Yes	Yes
17. Croatia	Yes		60. Peru	Yes	
18. Czech Republic	Yes		61. Philippines	Yes	
19. Denmark	Yes		62. Poland	Yes	
20. Ecuador	Yes		63. Portugal	Yes	
21. Egypt	Yes		64. Puerto Rico	Yes	
22. Finland	Yes		65. Romania	Yes	
23. France	Yes		66. Russia	Na	
24. Germany	Yes		67. Senegal	Yes	Yes
25. Ghana	Yes		68. Singapore	Yes	Yes
26. Greece	Yes	Yes	69. Slovak Republic	Yes	Yes
27. Hong Kong	Yes	Yes	70. Slovenia	Yes	
28. Hungary	Yes		71. South Africa	Yes	Yes
29. India	Yes	Yes	72. South Korea	Yes	Yes
30. Indonesia	Yes		73. Spain	Yes	
31. Ireland	Yes	Yes	74. Sri Lanka	Yes	
32. Israel	Yes		75. Sweden	Na	
33. Italy	Yes		76. Switzerland	No	
34. Japan	Yes		77. Tanzania	Yes	Yes
35. Kazakhstan	Yes		78. Thailand	Yes	
36. Kenya	Yes	Yes	79. Tunisia	Yes	
37. Kosovo	Yes	Yes	80. Turkey	Yes	
38. Latvia	Yes	Yes	81. Uganda	Yes	

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39. Lithuania	Yes		82. United Kingdom	Yes	
40. Macedonia	Yes		83. Uruguay	Yes	
41. Madagascar	Yes		84. Uzbekistan	No	
42. Malawi	Yes	Yes	85. Vietnam	Yes	
43. Malaysia	Yes		86. Zambia	Yes	Yes

The survey found wide divergence in national PPP policies with few regional PPP policies replicating national policy, few similarities between national policies and a variety of methodologies for assessing VfM with PPP procurement. What was evident, however, was the adoption of regional commercial principles and practices. For example, in South East Asian countries, bids are generally submitted in two stages, a technical proposal that includes compliance with legal and specification requirements and a statement about the track record and experience of the consortium and individual managers, and a financial proposal. This practice is not widely employed in Europe or North America. The survey suggests that the majority of countries have a procurement policy for transactions that include PPPs, BOT and concession contracts. The survey searched for PPP policies in each country using the word search term “value for money” and found 52% of the sample used the term but only 21% offered methods for its calculation. This suggests that in recent years, the use of VfM has been an aspirational policy objective and is not often used as an instrument for its calculation.

6.0 OECD Value for Money Survey 2011

Burger and Hawkesworth (2011) compared PPP policy frameworks for a sample of 20 OECD countries. The study examined VfM practices and the extent to which institutional frameworks influenced the scope and application of VfM principles in procurement and bidder selection processes for PPP projects. The OECD survey identified design differences between countries, and found that most countries (65% of the sample) limited policy application to national government and 35% included state/provincial and local government within its application. However, there were significant differences in policy design and Australia, for example, applies a uniform national policy but permits sub-national governments to modify policy to meet local requirements.

Countries implemented PPP policy under existing procurement law (45%) or as a specific PPP law or policy (30%). The *ex ante* assessment of VfM was required in 55% of countries and a further 25% required assessment above a prescribed value threshold. Only 15% of the sample did not require VfM assessment. Nearly all countries applied standardised VfM principles to all sectors of the economy. The PSC was used to calculate VfM in 85% of countries. By comparison, traditional procurement is measured using cost benefit analysis and lowest cost selection criteria and three countries conduct independent life cycle costing of traditionally procured projects. The investment decision precedes the choice of procurement method in 55% of countries with a further 15% of the sample doing this in more than 50% of cases.

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7.0 Results

The findings confirm that most OECD countries possess a national PPP policy that in most cases is integrated into a government procurement policy framework. VfM assessment is conducted during either or both the investment and procurement stages of the project for 16 countries (80% of the sample) of which five set minimum transaction sizes. The PSC was used to determine VfM in 17 countries (85% of the sample) which highlights the important role played by the PSC in determining VfM outcomes in OECD countries.

7.1 Survey of National PPP Policies

A survey of 18 national and 2 subnational governments was conducted by Burger and Hawkesworth, 2011, to identify differences in PPP policy design for a random sample of countries. The sample was selected to provide a representative group of countries in development terms and comprised seven governments in the first stage or factor-driven level of development (GDP per capita <USD2, 000), two in transition to stage two (USD2-3,000, three in stage two efficiency-driven economies (USD3-9,000), one in transition between stages two and three, and seven in stage three innovation-driven economies (>USD17, 000) (World Economic Forum, 2013).

There was little to distinguish sub-national PPP policies from those applying at national level although countries with a federal system of government are more likely to feature a constitutional separation of powers between central and provincial governments for provision of infrastructure. In Canada, Australia, India and the United States, the state or provincial governments provide infrastructure with financial assistance from the national government. The survey does suggest that stage three developed economies are more likely to employ VfM principles in their PPP policies than countries at a lower level of development (see the Burger and Hawkesworth, 2011 OECD VfM survey). Nevertheless, an omission of VfM criteria in the policy framework does not mean that VfM principles are not embedded in the procurement process during either selection of the procurement method and bidder selection, or by a requirement for a competitive bid processes. The majority of countries that explicitly refer to VfM criteria conduct the assessment at the feasibility stage of the project, 10% assess VfM in the bid selection process and 15% conduct the assessment at both the feasibility and post-bid stages.

On the question of explicit recognition of risk allocation in policy, 70% of the sample identify risk allocation as a major driver of VfM and refer to it as a policy objective. However, only 50% of the sample expressly assessed risk when calculating VfM. Some 15% of the sample did not use risk transfer to calculate VfM and 15% made no mention of it. On the question of the quantitative benchmarking of the procurement options, over half of the sample did not require options analysis or a PSC. The countries employing a PSC were countries in more advanced stages of development. The majority of countries in the sample used an output specification (65%) while the policies of the remainder were silent on the matter. See Appendix C.

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7.2 Results

The survey suggests a divergence in PPP policies between stage three (developed) countries and those at other levels of development. Stage three economies typically employ VfM principles in their policies both as an objective and as an assessment requirement, and explicitly include risk transfer, a PSC/quantitative measurement, or an output specification in their procurement decision-making. However, VfM can be achieved with a rigorous and well governed PPP process, a two-stage (pre-qualification and tender) bid process, competitive bidding and bid selection criteria that takes into account qualitative and quantitative factors. The evidence for stage three economies suggests explicit recognition of VfM as a PPP procurement objective and the adoption of an output specification, risk allocation practices, and quantitative benchmarking enable PPP policies to better harness the benefits offered by the PPP procurement method.

8.0 Conclusion: Value for Money and Policy Design

The assessment of bidder proposals is undertaken on a subjective case-by-case basis. The PSC measures the cost or quantitative differences between the PSC and bidders including matters such as the actual risk transferred to the contractor, completion time, compliance with the government's technical requirements, and financing costs. However, government may also benchmark bidder cost proposals against the costs incurred in earlier and like projects procured either traditionally or as a PPP. However, procurement options and individual contractor proposals may possess important qualitative differences in matters such as design and construction innovation, sustainability and improved service quality, which may make it difficult to use only a quantitative comparison between bidder proposals and between the preferred proposal and the PSC. A policy that uses both quantitative and qualitative criteria to evaluate proposals for contractor selection purposes provides government with better information to make an informed decision than a policy that does not possess these characteristics.

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Table 2: Malawi, Kenya and Mauritius

Criterion	Malawi	Kenya	Mauritius
Name of policy reviewed	PPP Bill 2010 http://www.malawilii.org/files/mw/legislation/bill/2010/3/public_private_partnership_bill_2010_final_copy_84896.pdf	PPP Bill 2012 http://www.kenyalaw.org/klr/fileadmin/pdfdownloads/bills/2012/The_Public_Private_Partnership	PPP Act 2004 http://www.commonlii.org/mu/legis/num_act/ppa2004295.doc
How is VFM defined	No definition but reference to VfM	The undertaking of a public function of the contracting authority by a private party under a PPP results in a net benefit accruing to that contracting authority defined in terms of cost, price, quality, quantity, timeliness or risk transfer	Net benefit to the consumers in terms of cost, delivery, price, quality, quantity or risk transfer, or a combination thereof.
When does the VFM determination take place in the project initiation process	Investment stage	Early stage feasibility study	Investment stage
Does PPP Policy provide detailed guidance for government agencies?	No	No	No it outlines the process
Does the policy require preparation of a comparative benchmark or a public sector comparator (PSC)?	No	No	No, general outline only
If a PSC is required, how is it defined or what needs to be done? (only want reference to the definition and instruction)		Not stated	
Transaction threshold in local currency or USD?	No threshold stated	No threshold stated	No threshold stated
Is a VFM test required for specific industry groups such as water, electricity, public transport, public buildings, roads and toll roads, health or education projects? What are the exemptions?	VfM applies to all PPPs and is required for economic and social infrastructure projects	Infrastructure	No differentiation
Oversight or governance?	Not stated	Governance	Not stated
Does VFM take into account risk transfer?	Yes	No details provided	Not stated
Any mention in the policy of competitive neutrality?	No	No	No
Does policy mention an output specification?	No	No	No
Does policy mention a PPP unit (of experienced practitioners)?	Yes, PPP Commission	A dedicated PPP Committee	Yes, PPP Unit within the Ministry

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Table 3: South Africa, Tanzania and Zambia

Criterion	South Africa	Tanzania	Zambia
Name of policy reviewed	Treasury Regulation 16	PPP Act regulations 2011 http://www.tanzania.go.tz/pdf/123456.pdf	The PPP Act 2009 http://www.zambialii.org/files/zm/legislation/act/2009/14/ppa2009295.pdf
How is VFM defined	How much it will cost for the institution to provide infrastructure and services compared to the costs of a PPP. If the comparison shows that a PPP is more cost-effective, the difference in cost between the two scenarios is known as VFM	No definition provided	Net benefit to agency or consumer in terms of cost, price, quality, quantity and risk transfer
When does the VFM determination take place in the project initiation process	Investment stage	Investment stage	Investment stage
Does PPP Policy provide detailed guidance for government agencies?	No, it outlines the key issues for justifying as a PPP	Yes	Yes
Does the policy require preparation of a comparative benchmark or a public sector comparator (PSC)?	Not stated	Yes	Not stated
If a PSC is required, how is it defined or what needs to be done? (only want reference to the definition and instruction)		Contained in the feasibility report	Not stated
Transaction threshold in local currency or USD?	Not stated	Not stated	Not stated
Is a VFM test required for specific industry groups such as water, electricity, public transport, public buildings, roads and toll roads, health or education projects? What are the exemptions?	VfM required for all PPPs	All industries	VFM test applied to all PPP transactions
Oversight or governance?	Not stated	Agency monitoring and reporting	Not stated
Does VFM take into account risk transfer?	Not stated	Not stated	Yes
Any mention in the policy of competitive neutrality?	No	No	No
Does policy mention an output specification?	Yes	No	No
Does policy mention a PPP unit (of experienced practitioners)?	National Treasury PPP Unit	Coordination and Finance Units provide this role	PPP unit and Council and Technical Committee

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RISK ALLOCATION IN THE ZAMBIAN CONSTRUCTION INDUSTRY

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Abstract

Risks are inherent on any construction project regardless of magnitude. The purpose of this paper is to show findings of an exploratory study conducted on risk allocation in the construction industry generally. The methodology adopted was a desk review of various standard forms of contracts used in ZCI and case law to briefly analyse how risks were identified, how they had been allocated and consequently how risks are dealt with. Risks can be shared, transferred or taken up by a single party to the contract. Further to this, the occurrence of a specific risk calls for a specific type of penalty or benefit to a contracting party depending on the contract used, areas covered include possession, site conditions, delay and extension of time, design risk, force majeure, indemnification, disputes, bonds, payment methods and liquidated damages. Contracts chosen should cover risks prevalent in a given legal jurisdiction as the result of how risk is dealt with is not common to all contract forms. The main importance of this work is that when adopting a contract for use, risks common to that industry should be identified and allocated appropriately especially when using standard forms of contract which when adopted for use have the option of adding/omitting clauses to suit needs of both the employer and employee.

Keywords: Construction, Risks, Risk Allocation, contracts

1.0 Introduction

All construction projects have risks (Wang and Lam, 2007). The construction contract agreement is a major tool for risk allocation is the construction phased. All modern contract agreements are directly concerned with providing clear risk allocation between the parties and good contracts assign risk to the party who can best manage them (Shnookal and Charrett, 2010).

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This research is an illustration of how standard forms of contract in the construction industry allocate risks with regards to possession, site conditions, delays and extension of time. There are also potential design risks, force majeure, indemnification, disputes, bonds, payment methods and liquidated damages in contracts. In order to manage risks appropriately they have to be properly identified and allocated. Traditionally risks are contractually passed on to the contractor.

- **Risk Defined**

Risk is defined as a "Hazard, chance of bad consequences, loss, exposure to mischance; exposing oneself to loss (Hughes and Murdock, 1992) while Bunni (2003) defines risk as "the combination of the probability or frequency, of occurrence of a defined hazard and the magnitude of the consequences of the occurrence.' In each and every circumstance when there is a question of a risk potential someone has got to bear the risk(s). Risk allocation is assigning management responsibility and accountability for risk(s) (Alsalman and Sillars, 2013). In construction the question of who bears the risks depends on the type of contract the contracting parties have signed. Different types of contracts allocate risks to parties differently but consideration of who bears the risk should be based on the following (Mead, 2007;-

- The risk is within the parties control
- When the risk can be dealt with beneficially by transferring it
- The economic benefit of a risk lies with the party to bear it and they can adequately plan for it
- If the party is the one likely to suffer loss when the risk is transferred

Having determined who is better placed to bear the risk, it is unfortunate that current practice carried out from major construction contracts seems to suggest otherwise (Ibid). The following is what is pertaining on the ground:-

- Risks are not allocated to the party best suited to manage them
- Risks assessments are rarely done
- Risks are allocated to party not best suited to manage them e.g. consultant and contractor
- Contractors are usually afraid to cost risk in the tender stage due to the fact that it would give increase the tender sum
- Most of the disputes are triggered by unjust risk allocation
- Saving of costs does not include factoring in risk

The types of risks common to the construction industry are those pertaining to design commonly referred to as design errors, there are also unexpected ground conditions, construction error, delays in and non-payment for the work done. Risk allocation in the construction industry has been occurring at various levels (Smith et al, 2007). Traditionally risk allocation theories describe them in the risk bearing context -client to designer and contractor; contractor to sub-contractor; client, designer, contractor and sub-contractor to insurer and contractor and sub-contractor to sureties or guarantors (Diepenbrock et al, 2006). From the theories, they seem to

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suggest that risk is never borne by the client but in each instance is passed on from the client to another party.

1.1 Types of Risks in Construction Contracts

The risks common to the industry have been identified but a list that may be encountered in construction projects is shown below.

Table 1: Showing risks covered in construction contracts as compiled from literature (Murdock and Hughes, 2007, Uff (2007 and Zou et al, 2007)

Physical works	physical conditions of the ground; artificial conditions causing obstruction; defective materials or workmanship; costs of testing and samples; weather; site preparation; inadequacy of staff, labour, plant, materials, time or finance
Delay and Disputes	possession of site; lateness in the supply of information; inefficient execution of works; delay outside both parties control; layout disputes
Direction and supervision	greed, incompetence; inefficiency; unreasonableness; partiality; lack of communication, mistakes in documentation; defective design; ensuring compliance with requirements; lack of clarity in specifying requirements; in appropriate choice of contractors and consultants; changes in requirements
Damage &injury to persons and property	negligence or breach of warranty; uninsurable matters outside parties' control; accidents; uninsurable risks such as war, usurped power; consequential losses arising from the aforementioned; exclusions, gaps and time limits in insurance cover.
External factors	- government policy on taxes, labour, safety, or other laws, delay or refusal of planning approval; financial constraints; energy and pay restraints; cost of war or civil commotion; malicious damage; intimidation; labour demands and unrest; strikes; lockouts; pickets
Payment	devaluation; delay in settling claims and certifying; delay in paying certificates; legal limits in recovery of interest; insolvency of contractor, sub-contractor or employer; funding constraints; shortcomings in the measure and value process; exchange rate fluctuations; inflation; any of this not covered by a fluctuation clause; replacement cost of plant and equipment
Law and arbitration	delay in resolving disputes; injustice; uncertainty due to lack of records or ambiguity of contract; cost of obtaining decision; enforcing decision; changes in statutes, new interpretations in common law
Technology	New technology, provisions for change in existing technology, develop costs, need for research and development

All the above problems are potential risk(s) on a construction project the biggest issue is the probability of a given risk. It is unusual to allocate a risk which is not foreseeable let alone price it.

1.2 Risk Allocation Theories by Classification

For risks to be allocated they first have to be identified, analysed and responded to. It is in the event of response that risks are allocated. Risk allocation is assigning management responsibility and accountability for risk(s) (Alsalman and Sillars, 2013). Various methods of risk allocation have been identified. Earlier researchers such as Carter and Doherty (1974), Thompson and Perry (1992) and Kelly (196) indicated responses as risk acceptance or retention, risk mitigation or reduction and risk elimination or avoidance and lastly transfer. This

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is also in line with the classification made by Mead (2007) who identifies them as risk acceptance, avoidance, elimination, transfer or insurance. Ehsan et al (2010) as an addition to the aforementioned, included monitoring and Smith et al (2006) adds doing nothing as a response to risk.

*Transfer of Risk (*Mead, 2007; Ehsan et al, 2010); this is the theory of risk which has its basis on allocating the risk on another party. It should be however be put into consideration that the party to bear the risk should be suited to handle the risk. The allocation is usually done by legal means, contract and insurance. For instance on the risk of performance by the contractor can be avoided by the employer by ensuring a performance bond is provided for in the contract. The employer would be entitled to some form of compensation from the bond providers. In a contract, transfer can be done through appropriated phrasing of a contract as to indicate the insurer to bear the specified risks.

*Acceptance (*Mead, 2007; Ehsan et al, 2010); this is when both parties accept that certain risks can possibly be handled and the necessary steps are taken to ensure that the risks are mitigated or shared. On the other hand risks that are unpredictable and are poorly defined should be dealt with by the client such as invasions. This is referred to as risk retention.

*Avoidance or risk reduction (*Mead, 2007; Ehsan et al, 2010); this involves the identification of risks and allocating them accordingly. Accordingly in the sense that those that can be handled are dealt with and those that cannot are assessed further. The assessment is to the extent to which the project can be affected, if the effects are found to be detrimental to the success of the project then the project can be abandoned altogether.

*Risk elimination (*Mead, 2007; Ehsan et al, 2010); this is when possible risks are identified and are dealt with proactively. In order to eliminate risk a risk analysis is to be done. A risks analysis is done to assess the probability of the occurrence of a given risk.

Doing nothing about the risk, this according to Smith *et al* (2006) should never be done, however Hughes and Murdock (2008) tends to be of the idea that at times it is a legitimate strategy. This can only be done when occurrence and the manageability of a risk is not clear.

Risk monitoring (Eshan, 2010) this can be employed by a predictive indicator to watch the project as it approaches a risky point. This is necessitated by having a contingency plan in place. The most common contingency plan is to set aside extra money, a contingency fund to be utilized in the event of an undesirable event such as unavoidable cost overruns.

1.3 Risk Practice in the construction industry

Appropriate risk allocation is important in the success of any project. It cannot be overemphasised that effective risk management of which risk allocation is a component of must

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permeate all areas, functions and processes of the project including the construction phase which is the main focus of this research (Schieng, 2006). Ehan *et al* (2010) highlights that the most utilised risk response measure in the construction industry are risk elimination and risk transfer. This usually results in delay, low quality and low productivity. Other studies show that usually, project participants allocate risks by aversion where owners tend to shift risks to the primary contractor, who in turn transfers them to the subcontractors (Sillars and Alsalman, 2012). The result of this is usually poor project performance characterised by cost overruns, poor quality and late completion, and tensions (Sillars and Alsalman, 2013). However construction companies that manage risks effectively and efficiently enjoy financial savings, greater productivity, improved success rates on new projects and better decision making (Banaitience and Banaitis, 2012).

2.0 Methodology

This paper is a desk study taking a qualitative approach in identifying risk allocation for a number of risk areas. The research started with a comprehensive review of relevant literature from text books, journal conference proceedings, and any other information to capture background knowledge on risk allocation in the construction industry. It has been established that construction is risk prone and that the fundamental document for risk allocation is the construction contract. Therefore the research opted to use the Joint Liaison Committee (1972) contract as a base line contract and compare it to other contracts used in the ZCI. The ZCI makes use of both local and international contracts. The Joint Contract Tribunal (JCT) 1998, New Engineering Contract (NEC) 2005, the International Federation of Consulting Engineers (FIDIC) 1999 and Joint Liaison Committee (JCT) 1972 will be used as points of reference on selected risks. In addition the JCT Building contract 1998 with quantities is also being used as there is evidence of its use in the ZCI. Risk factors that may affect a project are many as a result for this paper only clauses relating to site conditions, delay, extension of time, design, force majeure, indemnification, disputes, bonds, payment methods and liquidated dates were reviewed. In addition case law was used to show empirical evidence of the risks arising from the aforementioned. Zambia is a common law jurisdiction and has borrowed most of its legal foundation from the English system hence the use of cases in common legal jurisdiction was seen to be ideal. Cases indigenous to Zambia have not been used as it was difficult to find such cases. The methodology adopted was to go through various standard forms of contracts and case law to briefly analyse how risks arose, how they had been allocated (shared, transferred, ignored, or mitigated) and consequently identified some hiccups that could arise from a given risk.

3.0 Discussion of Contractual Risk Allocation in the Construction Phase

Various forms of standard forms of contract are available on the market and from the comprehensive list of risks tabulated earlier; there are risks that are common in standards forms of Contracts.

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Possession

Site possession is desirable on the date agreed in the contract. The late possession can lead to extension of time and cost overruns to the affected party. Consequently, chances of completing a project within the stipulated period are almost impossible without an added cost. It should however be noted that the works generally have liability allocated between different parties at different times. Under the JLC contract initial possession is given on the date stated in the contract (Clausen 21) in addition sectional possession is covered in clause 16. This clause allows for sectional completion and the employer is liable for damages caused to the property during this phase unless the employer does not take part possession or if the cause of damage to the work is due to the negligence of the contractor, then the contractor is fully liable. This is common to both the standard forms of FIDIC Red Book (1999) (1999) and NEC (2005) contract. However for delay in possession, extension of time and cost payment is the entitlement of contractor under Sub-clause 25.4.3.1 in JCT (1998), Standard form of contract, Private with Quantities). Given the foregoing this could be the common law position in the JLC contract.

Delays and extensions of time

This risk arises due to many circumstances for instance delayed drawings or instruction by Engineer (Sub-Clause 1.9, FIDIC) or the architect in the JLC and JCT contracts or Project manager (Clause 22, GCC). Circumstances leading to extension of time among others include force majeure, inclement weather, and civil commotion (Clause 23). The contract allocates risk of this nature by being borne by the party causing the delay except in cases where a notice core clause 24 has been given within the contractual time. This seems to be the position in the FIDIC and GCC clause 28 and clause 30.1. In the delay of late instruction caused by the employer the contractor is entitled to claim for extension of time and payment for such loss Sub-Clause 8.4 (FIDIC) , sub clause 24(1e) JLC and clause 41 (GCC) . Delay usually attracts payments and extension of time as was demonstrated in *Neodox limited v Swinton and Pendlebury Borough Council.* However a party may not be successful in escaping delay they caused once a claim is made as shown in *Walter lililly and Company v. Giles Patrick and Cyril Mackay and another*. This is in a case were the client engaged a contractor before the drawings were completed hence concurrent delay was caused. In JCT a claim for direct loss and /or expenses need not be followed by an extension of time, as evidenced *H. Fairweather & Co Ltd v. London Borough of Wands worth.* This is applicable to nearly all standard forms, entitlements depend on the circumstances.

Site Conditions

The most common risk for site conditions is unforeseeable ground conditions. These are usually two fold. Firstly, conditions found that are different from contract documents. It is common practice for drafters of documents to escape such liability by putting express liability disclaimers in such documents and the burden falls on the builder to satisfy himself with the site conditions

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unless there was no way of ascertaining ground conditions. Secondly, unexpected site conditions may be encountered. JLC is salient on site conditions however reliance is on the documentation provided by the employer about the site also the approach in GCC, sub-clause 14.1 hence it could be implied that this risk is on the employer should the documentation be incorrect. Under the FIDIC contract these are dealt with under Sub-Clause 4.12. If the contractor encounters adverse physical conditions which could not have been foreseen a notice is given to the engineer so as to enable the engineer to investigate and the Contractor is entitled to claim for extension of time and payment of costs incurred. The test of reasonableness is also demonstrated in the NEC which makes physical ground conditions a contractor's risk. Where there is no practical way of ascertaining the ground conditions the contractor is likely to succeed in a claim placing the risk on the employer as was held in *C. Bryant and son Ltd v. Birmingham Hospital Saturday Fund.* It is however the general law that there is no warranty by the employer that a site is fit for the works or that the construction of works will be to employers design. This risk is best dealt with by the client as he is best suited to carry out all the necessary investigations. However for such a claim to be successful a settlement offer calculation should be clearly constituted especially when a third party is a beneficiary (sub-contractor) and the claim is being made by perhaps the contractor to the employer this is clearly demonstrated in *Contain limited v Charles Haswell and partner ltd*.

Liquidated damages

Most standard forms of contract such as JLC, FIDIC and JCT allow the employer to be entitled to liquidated damages for the delay in delivery by the contractor where there is no further extension of time. The amount for payment is agreed to in advance and indicated in the appendices or particular conditions of contract (Clause 46, GCC). It is a sum which may be charged daily or weekly depending on the type of contract. A claim for liquidated damages should be made before the practical completion certificate is issued as evidenced in *Benfield Construction Ltd v. Trudson (Hatton) Ltd.* Queen's Bench Division (Technology & Construction Court) 17 September 2008. It should also be noted that NEC and JLC unlike JCT does not stipulate conditions precedent to the deduction of liquidated damages. NEC however requires an early warning procedure to be followed (core clause 16). This should be within 8 weeks of an event likely to call for payment of liquidated damages, should time go beyond this clause 61.3 puts a bar on any such claim. When time is beyond the stipulated period it is said to be at large hence liquidated damages are irrecoverable as in *Gaymark investments PTY LTD V Walter construction group* with precedence set in *Peak Construction V Mckinney Foundation ltd.*

Design Risk

The design risk is usually borne by the designer of the works in question. Clause 3 (JLC) is explicit about ensuring that the Architect makes the drawings available and are as clear as possible and by default the architect is to ensure that all designs are done by his team. Under GCC contract the employers design is his risk Sub-clause 11.1(b) and it appears that under

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this contract by default all designs are to be done by the employer. Under NEC contract, employer is expected to design everything; however clause 21.1 gives the contractor to design work which is described in the work information. Design of any part of the works by the employer's personnel or others for whom employer is responsible Sub-Clause 17.3 (FIDIC) will be their liability. On the other hand Sub-Clause 17.1 bodily injury, sickness, disease or death arising from contractors design will be his liability. When the owner designs the works the contractor is only responsible for building. If a design professional is negligent he shall bear the risk as evidenced in *Flowers v Torran Memorial Hospital Medical centre.* , 8 Cal 4th 992,997 1994. The contractor is usually not liable were he does not design, he is only responsible for carrying out the construction in accordance with the design as held in *John Mowlem and Co Ltd v. British Insulated Callenders Pension trust Ltd* were defects appeared in the constructed work due to inadequate design. Under JCT Clause 42 the contractor does not bear the risk for the architects' design.

Force majeure

Force majeure refers to a provision pronouncing an owner or a contractor blameless for payment for costs due to "Acts of God" and other external events such as war or labour strikes. The Force majeure clause usually puts liability on the employer to bear the risks in question. It should therefore follow that the claim should fall within the contents of force majeure for its application as demonstrated in *Thames Valley Power Ltd V Total Power ltd Gas and Power Ltd*. [2005] EWHC 2208 were due to an increase in gas prices the claimant wanted to terminate contract on a force majeure claim which was unsuccessful. JLC covers wars and outbreaks of hostilities in clauses (32 and 33) as employers risk but does not discreetly have a force majeure clause. It does not however detail other conditions that are Force majeure such as natural disasters. Employers risks according to Sub-clause 17.3 (FIDIC) and this is common to NEC (2005) Core clauses 8.

Indemnification

Indemnification is aimed at covering or underwriting risk, this provision specifically absolves the indemnified party (employer or contractor) from any payment for losses and damages incurred by a third party such as adjacent property owners. According to Sub-Clause 17.1 (FIDIC), the employer takes the risk of bodily injury, sickness, disease or death attributed to negligence of his personnel or any agents that are not catered for in insurance. The contractor bears the risk of bodily injury, sickness, disease or death arising from contractors design, execution and completion of works and remedying of any defects attributable to the negligence of contractor. In the event that the mentioned incident occurs the contractor will be responsible for indemnifying and paying expenses and damages for the affected, Sub-Clause 17.1, FIDIC and clause 19 JLC. The contracts ensure that each party is carrying the risk they can handle; this approach is also common to the NEC contract clause 83 this provides indemnification of each party by the other for risks that are that parties risk. In addition NEC entitles 3rd parties to

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enforce a term of the contract under the rights of third parties act of 1999 provided the person or organisation(s) are stated in the contract data. This is a legislative issue and third parties using NEC in jurisdictions where this third party act does not apply may not be able to enforce it. Care must also be taken to ascertain that risks under the indemnification clause are capable of being insured, the insurance agent may escapes liability resulting in the party absolving the risk being unable to benefit from insurance.

Disputes

Nearly all construction projects regardless of magnitude could have a dispute. Causes of disputes may include variations and claims (Yiu and Cheng, 2004), project uncertainty, imperfect contracts, unrealistic performance expectations, poor communication, poor interpersonal skills, opportunistic behaviour and cognitive discourse (Waldron 2006; Cheung and Yiu 2006; Mitropoulous and Howel 2001 and Diekmann *et al* 1994).

The JLC contract provides only for arbitration (clause 35) as a method of dispute resolution. The FIDIC Contract under Sub-Clause 20.2 provides for all disputes to be resolved by Dispute Resolution Board if the engineers' determination (Sub-clause 3.5) of the subject matter is unsatisfactory to the parties or a party. If resolution by the Dispute Adjudication Board is still unsatisfactory then the matter can be referred to arbitration.

Under NEC the starting point in resolving disputes is by adjudication. There is a two tier approach option W1 were adjudication is applied outside the UK and W2 were adjudication is applied within the UK and the Housing grants act , construction and regeneration act 1996 is applied. Once adjudication is unsatisfactory then arbitration or litigation may be used. In addition the contract offers a partnering approach in an effort to avoid disputes.

The JCT contracts provide for adjudication and Arbitration as method of dispute solution. Dispute resolution under while GCC has the project manager as the first person to resolve disputes (Sub-clause 24.1) when parties are unhappy with project managers decision then the dispute can be referred to adjudication (Sub-clause 24.2) and can only referred to arbitration by the unhappy parties if the referral is made within 28 days (Sub-clause 24.3) of adjudicators decision failure to which the adjudicators decision is final and binding.

The effort of the contracts to provide for a method of dispute resolution prevents any panic because disputants are aware of a mechanism to settle disagreements. However depending on the nature of the parties involved especially with a dispute resolution board mechanism it is not uncommon for the presence of boards to foster disputes. Care should be taken to follow the sequence of resolution methods as one party may stay proceeding in one method to resolve in their preferred method a problem not associated with the JLC contract. It is wise if a method in a contract is not preferred by both parties, to explicitly select preferred methods as the law may take centre stage in deciding on which method is to be used as shown in *Price and Price v*

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*Carter***.** It is also important to note the number of disputes to be referred for adjudication only one dispute can be refereed under the W2 (NEC) and several under the W1 see *R Durtnell & Sons v Kaduna Ltd [2003] BLR 225.*

Bonds

The employer fears the suspension of works and perhaps termination by the contractor resulting from reasons such as insolvency. In such instances the risk of employer losing his money can be minimized by the use of performance bonds. This is a surety bond issued by an insurance company or a bank to guarantee the satisfactory completion of a project by a contractor. In the Zambian Construction Industry it is usually a requirement that at bidding stage bonds such as bid bond and performance bond be obtained. JLC contract is salient about the performance bond, for retention it uses a cash retention fund. GCC provides obtaining for performance bond by the contractor which is supposed to be obtained by a specified date in the particular conditions of contract (clause 49). Clearly this risk is viewed with high importance in all contracts except JLC reviewed but more so in the FIDIC where possession cannot be given in the absence of the bond.

Payment Methods

Risk allocation can be done through a method of payment. The methods of payment widely used are fixed price and cost reimbursement. Fixed price is based on the contractors estimate. This type of contract may include for fluctuations or it may be a firm price contract. JCT contracts as well as the JLC with quantities allocate risk in this way. The implication is that a contractor is paid according to the estimate not what is incurred as cost. Cost reimbursement entails items are paid for depending on what contractor spends in executing the works. Most contracts make use of the two methods at varying degrees. Under FIDIC the contractor will be paid based on the estimate but in instances where a contractor is making a claim that entitles cost the cost plus method will be utilised. The contractor is entitled to be paid for expenses incurred which may not be agreed in the contract e.g. cost incurred from late instructions. NEC has various payment options under its six options with option A and C being the most common option A and B are lump sum contracts, Options C and D are target cost contracts, option F is a management contract and option E is a cost reimbursement contract. GCC contract can be used for lump sum contract with an activity schedule (Sub clause 39.4b) and for an ad measurement contract with a bill of quantities (Sub-clause 39.4a). It is evident that the preferred method is the lump sum placing most of the risk on the contractor.

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Table 2: Summary of risk allocation in construction contracts used in ZCI

Contract / Item	JLC 1972	FIDIC red Book 1999	NEC 2005	GCC 2013	JCT 1998 with quantities	Possible vitiating factors	Possible contractual entitlements
Possession initial possession and after practical completion	Employer or	Employer	Employer	Employer	Employer	Damage cause by party not in possession	Cost , Time
Design	designer	designer	designer	Designer	designer	Only liable for own portion of design	Cost, extension of time
Site conditions	Salient in contractual provisions	contractor	contractor	contractor	Contractor	Notice given, inadequate site investigation, conditions impossible to ascertain	Cost and extension of time
Delays and Extension of time	Party Causing delay	Party Causing delay	Party Causing delay	Party Causing delay	Party Causing delay	Notice given, contributory delay	Cost and EOT
Bonds (performance bond)	Salient in contractual provisions	To be acquired before possession	To be acquired	To be acquired	To be acquired by a stipulated date	Specific date, or before a given activity	
Indemnification	Indemnifying party	Indemnifying party	Indemnifying party	Indemnifying party	Indemnifying party	Risk should be insurable, additional legislation needed	Cost, EOT
Dispute resolution	Arbitration	Adjudication , arbitration, litigation		Engineers determination, adjudication, arbitration	Project managers determination, adjudicator, arbitrator	Sequence of dispute resolution methods, additional legislation needed, referral within time frame	Cost, EOT
Payment method	Lump-sum	Lump-sum, cost plus, target cost, management	Fixed price	Fixed price	Lump-sum/ ad measurement	Risk preference	cost
Liquidated damages	Daily or monthly amount only in PPC	Daily or monthly	Daily or monthly	Daily or monthly	Daily or monthly	Contributory delay	cost

Risk allocation method in contract

shared	Retention	Reduced	transfer	Ignored

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Clearly the JLC has allocated design, force majeure, indemnifiable risks, design risks, payment risks and liquidated damages in the same light as contracts reviewed to an extent. However payment method maybe modified to include other payment methods while Force majeure clause can be clearly marked as such with a comprehensive list of circumstances qualifying to be force majeure items. Site conditions should have a clause clearly outlining circumstances for application. In addition there is need to improve the contractual risk provisions on site possession in terms of which bonds and the implications of late possession, performance bonds- when they should be acquired and a clear clause in the contract, and lastly more options for dispute resolution should be included.

4.0 Conclusion

In construction risks are inevitable, what remains is to decide how the risks are going to be allocated. The best way of allocation is to ensure the risks are allocated to the party best suited to handle them. The JLC contract could be enhanced by possibly emulating possession and site conditions clauses from FIDIC, NEC, including a notice provision as an early warning procedure for expected extension of time, and force majeure clause, highlighting different scenarios for site conditions and also by adding more possible methods of dispute resolution, and various occurrences qualifying as force majeure. However, care should be taken to allocate risks appropriately especially when using contracts drafted in other legal jurisdictions where other legislation supports the enforcement of the desired result as was the case for indemnification for third party rights and dispute resolution methods supported by other legislation. There is need to study other risks in the JLC contract which is the objective for further research by ourselves.

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ASSESSING RISK IN INFRASTRUCTURE PUBLIC PRIVATE PARTNERSHIPS

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Abstract

Public private partnerships are a method for the delivery of social and economic infrastructure services in over 80 countries worldwide. PPPs are a contractual arrangement between public and private entities through which the skills, assets and/or financial resources of both sectors are allocated in such a manner that provides optimal service delivery and good value to society. Central to the operation of public private partnerships is the systematic evaluation of the procurement options available to government, an output specification to encourage private design, risk transfer, construction and operational innovation, the detailed analysis of projects over their operational life-cycle, a rigorous and competitive bid process, and the selection of proposals that deliver value for money.

Value for money is enhanced with other features of the procurement process. These include the selection of projects for PPP delivery that offer scope for risk transfer, the preparation of an output specification that creates an incentive framework for sustainable service delivery to requirements, governance and approval arrangements, the pre-qualification of contractors, and a competitive bid process. Value for money principles enable governments to derive more from their public private partnership programs. This paper reviews risk in PPP procurement arrangements and considers how it is integrated into a value for money analysis. International experience of assessing and managing risk in PPP projects is presented to illustrate the dimensions of risk evaluation in various types of projects.

Keywords: risk, public private partnerships, value for money.

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1.0 Introduction

First introduced as part of the Private Finance Initiative in the United Kingdom in the 1990s, public private partnerships (PPPs) have come into wider use around the world as an important method for government procurement of economic and social infrastructure services. In contemporary practice, the PPP is a specialised form of procurement that changes the role of government from owner and manager of infrastructure assets to a buyer of infrastructure services. PPPs are a method of public procurement that employs a combination of private sector capital and management to deliver infrastructure services to, or on behalf of, government (Regan 2010). To determine which procurement method is best for government, a comparison of the procurement options is undertaken in the early stages of the procurement process.

Value for Money (VfM) enables government to measure two key dimensions of infrastructure procurement. First, it requires government to undertake a detailed *ex ante* quantitative evaluation of a project over its life cycle in order to compare and select the best procurement option. Second, with adjustment for risk and competitive neutrality, it provides a means of comparing the most efficient procurement mechanism available to government with proposals received from contractors in a competitive bid process. In this second application, VfM will also take into account the qualitative dimensions of a proposal thereby equipping government with the information to make an informed selection of the bid that best meets the service requirement contained in the specification, and offers the best financial return.

There are two important drivers of VfM in PPP contracts. First, the transfer of project and service delivery risks from government to the contractor. This may include risks associated with construction time and cost, life cycle costing, operations, finance, connectivity to support networks, industrial relations and environmental management. These risks are transferred when the contractor is in a better position to manage the risk at lower cost than government. Second, a competitive bid market also drives VfM because contractors compete on the basis of time and price, their experience and efficiency, track record, the innovation that they bring to the construction and operational tasks, and the added value that they can bring to the service delivery objectives of government.

2.0 Risk in the Public Sector Comparator (PSC)

The Public Sector Comparator (PSC) is an estimate of the risk-adjusted, whole-of-life cost of the project if delivered by the State. The PSC is developed according to the same output specifications included in the Project Brief and assumes the most likely and efficient form of conventional (i.e. non-PPP) delivery by the state.

The PSC is expressed in terms of the net present cost to the State, calculated using discounted cash flow analysis and seeks to take full account of the costs and risks of that method of procurement. The PSC includes amounts to cover the design and construction costs and the

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maintenance, operation and facilities management costs during the Project Term. The PSC plays an important role in the evaluation of proposals and the assessment of VfM. However, its accuracy depends on the assumptions used to establish costs, and to identify, measure and price risk. The PSC should be robust and consistent with the project scope issued to bidders (KPMG, 2011: p. 2). The elements of the PSC are the "base" or "raw" PSC, which is a costing of the asset or services under government ownership and management, an adjustment for competitive neutrality, the value of risk transferred to the contractor, the risk retained by government, and the discount rate. These are shown in Figure 1.

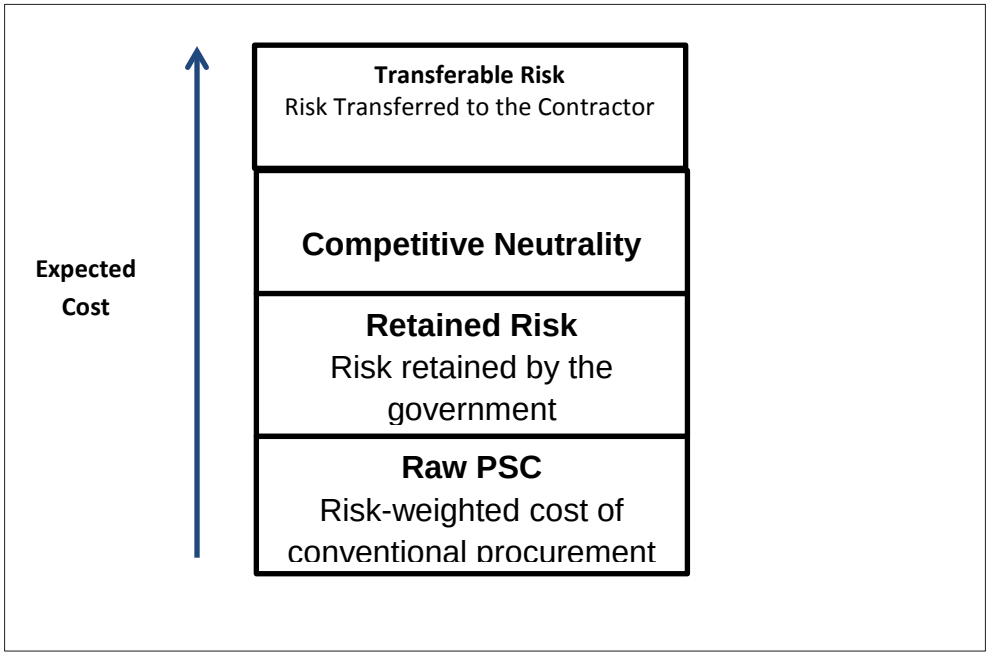

Figure 1 Composition of the Public Sector Comparator

2.1 Elements of Public Sector Comparator

The base PSC provides a costing for delivery of the project as a traditional procurement owned and operated by the government, including capital and life cycle costs and delivering services over the same period as the proposed term of the PPP and to the standard of service as defined in the output specification. The base PSC also includes the following elements in addition to the risk elements noted above:

- An output specification and scope of works;
- All capital and operating costs associated with building, owning, maintaining and delivering the services to the standard required in the specification;
- The application of discounted cash flow methodology at the recommended discount rate;
- Adjustments that reflect income from third parties.

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The costs included in the base PSC are land and development costs, professional fees for design and development approvals, building materials, the cost of professional advisers, plant and equipment, and raw materials. For the operating period, the costs will include employee wages and salaries, consumables, direct management costs and insurance, plant and equipment, rates and taxes. The base case PSC is not generally distributed to bidders although some policies recommend the agency distribute the base case as a guide to bidders in the request for proposal stage (for example, Partnerships Victoria, 2003: p. 9).

2.2 Competitive Neutrality

In a competitive market, government holds a number of advantages when bidding against private firms. Competitive neutrality is an adjustment that removes the net competitive advantage that accrues to a government business because of its public ownership. It is designed to recognise material advantage (and disadvantage) that government may hold in comparisons with non-government institutions, such as an exemption from stamp duties, income and payroll taxes, and the management costs of corporate and other services that government may not explicitly recognise such as accounting, human resources and administrative services. The purpose of this adjustment is to ensure elimination of competitive advantage in a like-for-like comparison of the two estimates.

2.2.1 Transferable Risk

The optimal allocation of risk is a key objective of PPP policy and maximising VfM. The decision to allocate risk to the contractor depends on whether the bidder is best able to manage the risk at least cost. This involves an optimal rather than maximum transfer of risk and requires assessment of the contractor's risk appetite and capacity to mitigate and manage risk determined on a case-by-case basis. Transferring risk that the contractor does not have the capacity to manage may result in excessive risk premiums being factored into the availability payment that contractors will charge government, and diminishing VfM in the process.

2.2.2 Retained Risk

This refers to risk retained by government and generally relates to the output specification and the core services delivered by government. For example, in a PPP project for a regional hospital, it refers to risks associated with the delivery of medical services, the selection and training of medical staff and the optimal utilisation of hospital facilities. Retained risk may also take into account the cost of insuring assets and operational risks, such as public liability risk premiums. Figure 2 shows the components of risk in the PSC and how the bids are managed to include the risk components.

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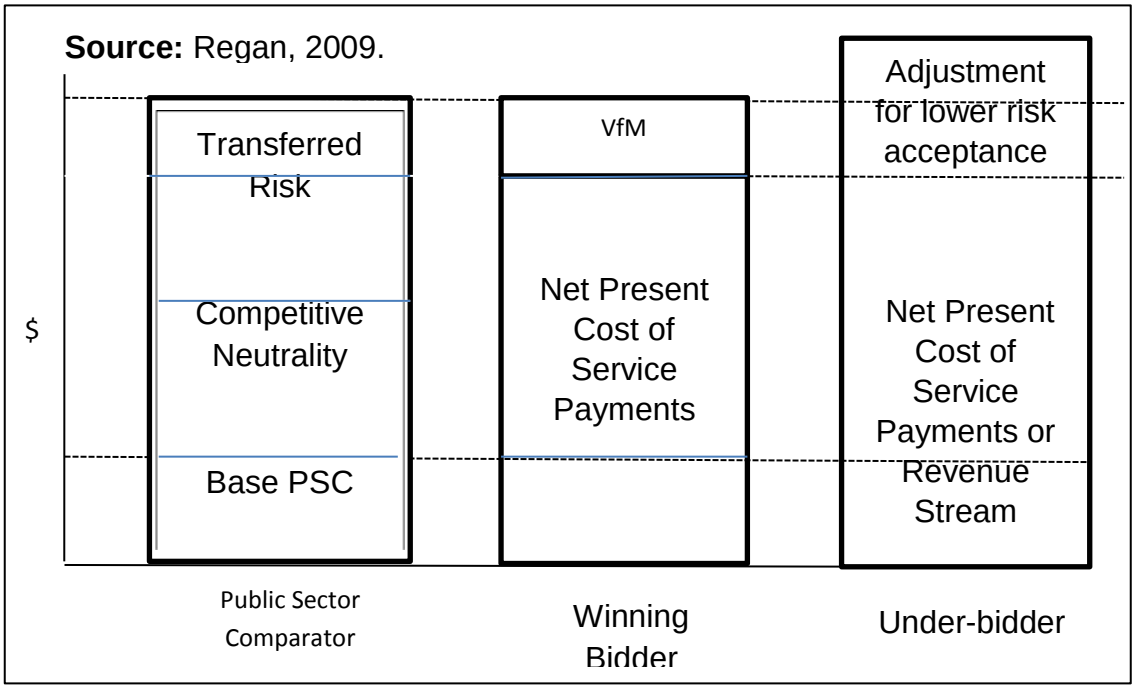

Figure 2 - Public Sector Comparator

2.3 The Discount Rate

The forecasting of future revenue and costs for the PSC or a shadow bid is based on standard investment principles and discounted cash flow (DCF) methodology. The DCF requires a cash flow forecast, underlying assumptions, initial and residual capital values and a discount rate. The selection of a discount rate for government investment is one of the more contentious areas of public economics and is essentially a government policy decision. Discount rates may be calculated using one of several methods: social time preference (a value calculated for the price the community will pay to defer immediate consumption), social opportunity cost (the marginal return on investment from alternative state investment opportunities), or a nominated proxy for both methods being the marginal cost of state debt (Harrison, 2010). Governments generally simplify this process by prescribing the discount rate to be used for public infrastructure investment from time to time.

In OECD countries, the discount rate is generally the marginal cost of government debt, the so-called risk free rate of the country (HM Treasury, 2011). In other jurisdictions, the discount rate may include an adjustment for unsystematic risk, which refers to risks associated with the subjective circumstances of the project under consideration, such as supply chain or market demand risk. In sub-national jurisdictions, the discount rate may also be adjusted for systematic risk, which cannot be eliminated by diversification and affects all investment activity within the jurisdiction, such as political and fiscal risks (Partnerships Victoria, 2003).

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In non-OECD countries, Treasury will generally issue policy directives for agency application of investment discount rates. In most countries, this rate is the marginal cost of state debt.

3.0 Qualitative Analysis

The qualitative elements of contractor bids may be taken into account when determining VfM with PPPs. Typically; these are matters that bring benefits to government, such as unique construction technologies, innovation in construction or early completion for accelerated service delivery. The qualitative attributes of a contractor proposal that contribute to VfM may be complex and difficult to identify and specify in advance. The benefits to government are not always similar for different types of projects. The things that deliver qualitative performance include early completion of assets and early delivery of services, innovation in design and construction methods and materials, better service outcomes, improved capital productivity, third party revenue, and the expertise and capacity of the contractor to meet service delivery requirements over the life of the project. There are many additional factors that can be taken into consideration although this will depend on the particular characteristics of the project being procured. In some jurisdictions it may include social impacts such as access and amenity, and a public interest test that takes into account factors that are important for both social and economic infrastructure services and will generally be reflected in benefits to government not available with alternative procurement methods. Some examples from the literature are shown in Table 1.

Table 1: Qualitative Risk Factor Examples

Qualitative Risk Factors	Case Study Examples
Unquantifiable risk transfer to contractor	Berlin Wasser, Germany
Contractor experience, financial strength, expertise and capacity of project lender	Channel Tunnel Rail Link, United Kingdom Desalination Project, Victoria
Innovative design and construction management (example, off-site prefabrication)	Southern Cross Railway Station, Victoria Royal Children's Hospital, Victoria
User benefits over and above specification	NHS Romford, United Kingdom County Court Building, Victoria
Service sustainability without subsidy	ASA and Rethmann PPP, Hungary
Complies with a public interest test	Eastlink Toll Road, Victoria
Compliance with new environmental laws	Apa Nova Water, Romania
Improved community access	Southern Cross Railway Station, Melbourne
Access to expertise, efficiency and	Apa Novo Water Project, Romania

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technologies not otherwise available to government	Scottish Water Solutions, Scotland Dublin Wastewater Scheme
Compliance with environmental standards	Scottish PPP Water Projects, Scotland
Technology transfer	Berlin Wasser, Germany
Noise abatement at airports	Hamburg International Airport
Service performance	Darent Valley Hospital, United Kingdom

Sources: European Union 2004, National Audit Office 2005; European Commission 2004, *Resource Book on PPP Case Studies*, Directorate-General Regional Policy, Brussels; National Audit Office 2005, *Improving Public Services through better Construction*, HC 364-1, Session 2004-05, London, March.

Qualitative benefits may take several forms including non-conforming bids that accompany a conforming PPP proposal. Examples of qualitative benefits include additional works for a toll road project that increased the total distance by several kilometers (Victorian Auditor-General's Office, 2007), creative design work for a new transport interchange complex that improved visual and community amenity in its precinct (Victorian Auditor-General's Office, 2007); new school buildings that improved operational flexibility, air quality and sustainability in PFI schools (National Audit Office, 2005); contractor use of automated toll collection for a PPP motorway which improved traffic flow and trip times for users compared with conventional manual toll collection (Victorian Auditor-General's Office, 2006). Qualitative evaluation generally follows the quantitative assessment of bids. Qualitative factors such as lower user charges, improved service quality, improved asset utilisation and early completion may outweigh higher cost to government in some cases although the final assessment is best undertaken on a case-by-case basis.

4.0 The Role of Risk in Value for Money

The primary driver of VfM in PPP projects is the transfer of project risks to private contractors. The principle underlying risk transfer is that risk should be borne by the party best able to manage the risk which implies the least cost. So, construction risk is best borne by the construction contractor and finance risk by the financier(s).

4.1 What is Risk?

Risk is any outcome at variance to expectation and is a particular problem with complex infrastructure projects in which the likelihood of cost and time overruns is high. In a PPP project, risks may include site risks such as pre-existing soil contamination and poor sub-soil stability, construction risks such as time and cost overruns and industrial disputes, and life cycle cost risk, which is the estimation of all capital and operating expenses to be incurred over service

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intervals of up to 20 years or longer. Risk may have a positive or a negative impact on project revenues and costs.

Most design and construction risks are well known to contractors, form part of the day-to-day management of a construction company and are factored into the cost structure of contractor bids. However, there are risks that the construction company may be asked to carry under a PPP contract that do not form part of their day to day core business, such as project finance risk, network, operational and life cycle cost risk. When these risks are allocated to the private sector, it is essential that bidders understand the risks that they are accepting, can measure and value those risks, and put in place controls for their monitoring, mitigation and management.

Table 2 shows typical PPP risks at the various stages of the project.

4.2 Valuing Risk

Before adjusting the PSC for retained and transferred risk, it is important to develop a risk valuation methodology. Risk is central to delivering a successful project and it is measured by assessing the probability and cost of an outcome at variance with expectation. Quantifying risk forms part of project risk analysis, which is a process for identifying, measuring, valuing and managing risk, and to some degree, anticipating and mitigating the uncertainty associated with infrastructure projects. Risk is a dynamic variable, its effects may be cumulative or spontaneous and the riskiness of projects increases with complexity and with time. Risk is also difficult to forecast and PPP procurement requires government agencies to develop a good understanding of risk analysis methods employed in delivering economic and social infrastructure services. For example, cost overruns, late delivery and force majeure events are risks that may have a negative impact on the contractor's financial economics or may delay the delivery of services to the community. An examination of the history of risk throughout human history is provided by Bernstein (1998). The distinction between risk and uncertainty is made in Knight, 2006 (a reprint of the original 1921 treatise) and Keynes (1921).

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Table 2: Typical Public Private Partnership Project Risks

Risk Category	Typical Risks
Pre-Design Risk	Suitability of the output specification Development consents, permits and approvals, stakeholder consultation Tenure, site access and network issues (connectivity to utilities and services)
Site Risk	Site conditions, contamination, environmental impact assessment and approvals Existing buildings
Design and Construction	Construction time and cost, fitness for purpose, weather, change in scope or specification, technology interface, quality of building for life cycle cost risk Hold-up risk, changes in scope or specification
Market Risk	Risk of insufficient market demand, tariff setting and escalation factors
Technology	Technology failure
Financial Risk	Interest rates, compliance with lender covenants, currency exchange rates
Technology Risk	Downtime and third party risk with technology failure
Operational Risk	Life cycle cost risk, repair and maintenance risk, accelerated asset deterioration
Network Risk	Access and pricing, regulatory interventions, interface relationship management
Industrial Relations	Delays caused by industrial action
Political Risk	Change of law, tax regulation
Force Majeure	Unanticipated exogenous events such as floods, earthquakes, war and riots

The proposals received from contractors will be based on recognition of a number of risks not included in the PSC. These may include the risk of government cancellation of the bid process, change of taxation and other laws that adversely impact the project and government appropriation of assets without fair compensation. Private bidders may need to consider risks not normally borne by government such as capital raising and underwriting costs, credit and

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sovereign risk insurance, expenses related to bond issues, compliance with lender covenants regarding financial management, the term of loans, refinancing risk, withholding taxes on foreign remittances, interest rate and currency exchange risks. The bidder proposals will include a risk acceptance schedule and a unitary or user pays charge based on its risk- weighted costing of the PPP project.

A relatively simple method of risk valuation for infrastructure projects is the qualitative probability approach which requires the analyst to identify a risk event, measure the cost of the impact, and multiply the cost of the impact by the probability of its occurrence. The formula for risk-weighting an expenditure estimate is as follows:

Risk weighted cost = Original prime cost + (Cost of a risk event x Probability)

Assume a prime cost of $100, a risk that would add $25 to the prime cost if it occurs and a 20% probability that it will occur:

Risk weighted cost = $100 + ($25 x 20%) = $100 + $5 = $105

The importance of risk-weighting is that it quantifies risk for the purposes of risk allocation and preparation of the project budget.

4.3 Risk Allocation

Most design and construction risks are well known to construction firms, and form part of the day to day management of a construction company. However, risks that the construction company may be asked to carry under a PPP contract that are not part of their day to day activities, such as project finance risk, operational and life cycle cost risk may be absorbed by the company and managed internally or sub-contracted out to others such as insurance companies. They may also be rejected by the company in which case the VfM outcome may be weakened because of the value placed on risk transfer for the PSC and VfM assessment. Table 3 summarises the PPP risk allocation responsibility on a typical project identifying some of the risks noted earlier in Table 2.

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Table 3: Typical Public Private Partnership Risk Allocation Schedule

Risk Category	Description	Responsibility
Existing Structures	Suitability of existing buildings for use in redevelopment	• Government
Site Conditions	Pre-existing contamination Construction contamination	• Government Contractor
Environmental Risk	Compliance with Environmental Management Plan for redevelopment	• Contractor
Design	Fitness for Purpose	• Contractor
Construction	Responsibility for time and cost risk	• Contractor
Industrial Relations	Labour disputes and hold-ups	• Contractor
Commissioning	Delays and rectification costs	• Contractor
Demand for Services	Derivation of third party revenues	• Contractor
Network Risk	Connectivity to supply chain	• Contractor
Life cycle Cost Risk	Responsibility for cost blow-out	• Contractor
Political Risk	Change of Tax Law	• Government
Financial Risk	Interest and exchange rate risk	• Contractor
Force Majeure	Non-insurable calamity	• Contractor

5.0 Informal VfM Assessment

In some countries, PPP policy may endorse VfM principles without providing specific criteria to determine how VfM will be calculated. The reasons for this may be that government needs to fast-track projects or the government's fiscal position limits public investment options. The informal assessment of VfM uses systematic approaches to the procurement process that embeds VfM principles in project evaluation and procurement methodologies.

In jurisdictions where a formal VfM process is not required, a comprehensive procurement process that embeds VfM principles may achieve a similar outcome. The elements of a VfM procurement process include a detailed feasibility or procurement options analysis, a pre-qualification procedure, competitive dialogue, technical and administrative requirements that incorporate quantitative and qualitative performance benchmarks, and adoption of a gateway system that prescribes the stages through which a project must pass before it is finally approved. Delmon (2009: p. 13) describes this approach as "… a holistic assessment of the project delivery and the marginal benefits provided by private investment and the competitive procurement process used". The procurement measures commonly used to improve VfM outcomes include:

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- Comprehensive evaluation of the service needed to guide agency decision-making during the investment and procurement stages of the project;
- The preparation of technical requirements for the project;
- A framework for the systematic identification, measurement and optimal allocation of risk particularly life cycle cost and operational risks, force majeure, finance and construction risk;
- An experienced and well-trained agency PPP project management unit;
- A two stage bidding process requiring pre-qualification before the request for proposal is issued;
- A competitive bid market;
- Bidder selection criteria incorporating quantitative components (risk transfer, cost to government, technical requirements) and qualitative components (contractor expertise and track record, design and construction innovation, early completion).

A PPP policy that adopts most of these principles has a greater likelihood of achieving VfM outcomes for government than a PPP policy that does not. However, informal VfM methods do not provide government with sufficient data with which to improve the procurement process, document lessons learnt, raise the skill levels in line agencies and optimise risk transfer with future projects. These outcomes can only be achieved with the adoption of a formal approach to VfM assessment.

A number of countries use a competitive bid market to enhance VfM outcomes. The competitive bid market approach is based on the assumption that private infrastructure procurement delivers projects at lower cost and in shorter periods of time than traditional public procurement methods and represent a better VfM option for government. Competition between private contractors in a well-managed bid market is considered the one of the key drivers of VfM with PPPs (Ismail, et al., 2011).

VfM is more likely to be produced by a competitive procurement process over one that is not. However, competitive bidding alone does not ensure VfM outcomes. When this option is chosen, the government will generally prepare an output specification, consult widely with the market ahead of the bid, make an allocation of project risks and proceed with a competitive bidding process. This is the practice adopted with many concessions and BOT contracts and it relies on a competitive bid market to deliver a better outcome for government than could be achieved with traditional procurement, which is widely accepted as the benchmark for measuring procurement performance. Unlike a PPP, a traditional contract based on an input specification is an adversarial contract and contractor selection employs criteria heavily weighted toward lowest cost. Policies that use competitive bid markets rely on bidder depth, transaction flow, risk transfer, and rigorous management of the bid process. Procurement method is also important and policies may require a minimum number of bidders, pre-qualification, open or closed bids, and competitive dialogue during negotiations. In some jurisdictions, a best and final offer may be requested from short-listed bidders although this may

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contribute to hold-up delays and rapid escalation of bid costs if not carefully managed. Experience in a number of OECD countries suggests that VfM outcomes are determined by the efficiency with which government manages the competitive bid process, an appropriate risk allocation strategy, and post-selection negotiations to ensure achievement of the best VfM outcome (Delmon 2009, pp. 13-15). Most international PPP policy frameworks now require competitive bidding for PPP projects.

6.0 Conclusion

The PSC is a standard measure for assessing VfM across all disciplines and agencies provides a methodology for comparison between proposals. The PSC contains a significant element of embodied risk; retained risk by the government or agency, risk-weighted cost of conventional procurement, and transferable risk to the contractor. The advantages to government of using a PSC is that it develops agency skills and experience in activities such as options analysis, risk-weighting financial forecasts of projects for risk allocation and management purposes, life cycle cost measurement, discounted cash flow analysis of government investment activities, and a better understanding of optimal methods for financing major projects. The PSC also requires government agencies to take into account the qualitative dimensions of procurement decision-making including the contractor's experience and track record, the identification of efficiencies through contractor design and construction innovation, and indirect benefits in the form of improved productivity, technology transfer, improved services and compliance with international environmental and other standards.

The PSC plays an important role in the evaluation of proposals and the assessment of VfM. However, its accuracy depends on the assumptions used to establish costs, and to identify, measure and price risk. The PSC should be robust and consistent with the project scope issued to bidders (KPMG 2011, p. 2). A review of the international evidence (Regan, et al., 2011) suggests PPPs that use the PSC with integrated VfM evaluation criteria are achieving improved procurement outcomes for government. This is more prevalent with larger and more complex projects that make greater use of risk transfer, innovation, technology, and a competitive bid market. International evidence suggests that PPPs are lowering the cost of services to government, improving regional economic performance, and are making a significant contribution to improved service quality. Examples include reduced in-patient stays and faster recovery times in public hospitals, better educational performances in state schools, improved efficiency in waste management, water supplies and recycling, better asset utilisation and faster delivery of services.

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RISK ALLOCATION IN PUBLIC PRIVATE PARTNERSHIPS – A DECISION-MAKING FRAMEWORK FOR ZAMBIA

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Abstract

Zambia, like most developing countries, has lagged behind in infrastructure development. Due to challenges of insufficient public income, increased urban migration and unstructured governance systems, social and economic under-development has been the result. In 2009, the Public Private Partnership (PPP) Policy and Act No.14 was enacted to reverse the trend of stifled development. The enactment was meant not only to have legislation governing PPPs but to also instigate development using private financing. Unfortunately, PPPs may have been perceived as the ultimate solution for the country's lack of development and not merely as an alternative mode of procuring major social and economic infrastructure. Developing countries, in Africa especially, are perceived to have risks that may disrupt the implementation of projects. In Zambia, contract administration under the PPP Policy and Act has been marred with unclear procedures and enumerable risks. Using structured interviews, information was gathered on the risk allocation decision-making processes on PPPs. A decision-making framework is proposed for the implementation of PPP projects in Zambia.

Keywords: Risk allocation, Public Private Partnership, Infrastructure, Decision-making framework.

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1.0 Introduction

Reduced expenditure, poverty reduction, inadequate infrastructure and increased demand for higher levels of services from governments in Sub-Saharan Africa, has been fraught with many problems achieving very little success in terms of development (Ndandiko, 2006). Direct government involvement in the provision of public services has now been enhanced by alternative procurement forms such as Public-Private Partnership arrangements (PPPs) (Herzberg and Wright, 2005). According to the Africa Infrastructure Country Diagnostic Report,

Zambia needs to spend US$1.6 billion a year over the decade 2006 – 2015 to develop its infrastructure to the level found in the rest of the developing world. This estimate is equivalent to 20% of Zambia's gross domestic product (GDP) and it is double the country's rate of investment in recent years. IBRD (2010) estimated Zambia's infrastructure funding gap at US$500 million per year. This research is part of a doctoral thesis that seeks to highlight unclear procedures in PPP implementation hence the proposal of a decision making framework.

2.0 Literature Review

Public Private Partnerships (PPPs) have several definitions. Most definitions often retain the central feature of participation of the public and private parties. PPPs have been described as complex type of contracts which work on the premise of a synergy of the public and private sectors (Zulu and Muleya, 2009, Alshawi, 2009). Hodge and Greve (2007) called for the re-examination of the different meanings and definitions given to PPPs. Akintoye (2009) defined PPPs as contractual agreements of shared ownership between public agencies and private companies, whereby as partners, they pool resources together and share risks and rewards, to create efficiency in the production and provision of public and private goods traditionally provided by the public sector. Koppenjan (2005) opined that it is 'A form of structured cooperation between public and private partners in the construction or maintenance and operation of construction and infrastructural facilities in which the partners share or re-allocate risks, costs, benefits, resources and responsibilities over a long period'. Ahadzi and Bowles (2004) stated that it is essentially 'a form of collaboration between the public and private sectors'.

Governments all over the world have relied on the private sector for the provision of infrastructure (Hood and Young, 2003; Cheung et al, 2010). There is a general admission amongst researchers of lack of a standard method of PPP implementation (Alfen et al, 2009). Gallimore et al (1997) reported that a major motivation for public sector agencies actively seeking to participate in Private Finance Initiative (PFI) projects was the expectation that capital spending was likely to fall by 12 per cent in real terms for the project.

Adams et al (2006) suggested three reasons why PPPs are being used:

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- that they reduce the burden on taxpayers in the delivery of both capital and long term service contracts by the introduction of private capital, expertise and competitive business practices to the provision of public services;
- the private sector has a higher level of efficiency and effectiveness than the public sector which is hindered by its highly bureaucratic and politicized operative processes; and
- risks associated with the provision of such infrastructure can be spread between the private and public partners hence relieving taxpayers of some of the costs incurred by decision taken long ago.

Demand for public services coupled with the fiscal crisis in the public sector has led to a new set of circumstances. The OECD (2008) predicted that the world economy is expected to grow at about 3 percent per annum to the year 2030. Much of this growth will be in developing countries. Latham (2006) pointed out that government intervention does not necessarily mean direct provision of services but can be brought about by means of:

- managing the market,
- intervening directly to ensure public outcomes or
- contracting non-state providers.

Governments have to undertake such service delivery through the option of decentralized management and market mechanisms (Pongsiri, 2002). Governance is therefore a matter of concern. Stoker (1998) defined governance as the development of governing styles where the principles of accountability, transparency, fairness, efficiency, participation and decency are embraced. Alfen et al (2009) defined governance as a decision-making process. Governance must therefore embrace transparency in all its decision-making processes. Abednego and Ogunlana (2006) developed the good project governance (GPG) concept that is aimed at evaluating performance under the PPP procurement mode. Abednego and Ogunlana (2006) further argued that proper risk allocation is only achievable through good governance which in turn leads to better project performance (Guasch, 2004; Qu et al, 2013).

The New Public Management (NPM) has been defined as a set of management approaches and techniques, borrowed mainly from the private sector and applied in the public sector. NPM characteristics from the private sector included (Dent et al, 2004):

- greater ‘disaggregation’ of public sector organisations into separately managed units;
- enhanced competition and use of private sector managerial techniques;
- emphasis on discipline and parsimony in resource use;
- increased ‘hands on management’;
- adoption of measurable standards of performance; and
- use of ‘pre-set output measures’.

Ultimately, the provision of public services is finding expression in the public private partnership model. Consequently, the PPP style of management is termed as ‘social learning’ whose task is to ‘establish relationships and forums of interaction between government, business and non-profit organisations’ (Neufville and Barton, 1987).

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3.0 Infrastructure Investment

Byrne (1984) gave a comprehensive definition of infrastructure development that is in line with this research. He enumerated the characteristics of development as the:

(i) perception and estimation of demand for new buildings of different types;
(ii) identification and securing of sites on which buildings might be constructed to meet that demand;
(iii) design of accommodation to meet the demand on the sites identified;
(iv) arrangement of short- and long-term finance to fund site acquisition and construction;
(v) management of design and construction; and
(vi) letting and management of the completed buildings.

Infrastructure development has been the key driving factor for PPPs across the world. Shaoul (2009) acknowledged that countries around the world have turned to PPP to finance the much needed infrastructure. Li and Akintoye (2003) countered the argument that PPP usage is 'uneven and recent'. They cited examples of the increasing use of the Build-Operate-Transfer (BOT) contract by financiers and construction companies aimed at financing, constructing and maintaining economic infrastructure. Other methods being used are outsourcing that contract out general and technical services to a third party (Pongsiri, 2002). There is advantage in such a contract in that government alliance with a third party ensures control. France is rated as having the longest history of private sector involvement for public goods provision. Li and Akintoye (2003) adduce evidence that show that private sector involvement for the water infrastructure increased from 31% in 1854 to nearly 61% in 1980 and 75% in 1991. There is greater willingness in the French public transferring the construction and operating risk to the private sector mainly through the use of the BOT model. Chinyio and Gameson (2009) reported of the extensive use of PPPs for tunnels, roads, stadiums and prisons.

3.1 Risk Studies

Studies in construction risk have been extensively covered and particularly those that affect PPPs by Cohen (2007) and Akintoye et al (2003). The matrixes of risk that are adopted evince differing characteristics such as are displayed in Schaufelberger and Wipadapisut (2003), Grimsey and Lewis (2002) and Li et al (2003). The most common classification of risks views them as either 'external' or 'internal' (Li et al, 2003; Schaufelberger and Wipadapisut, 2003 and Grimsey and Lewis, 2002). Ke et al (2010), Chan et al, 2010, Xu et al, 2010 and Roumboustsos and Anagnostopoulos (2008) utilise an adapted version of the Li et al (2003) list. The bifurcation of risk is therefore a matter of preferred preference. However, such taxonomy must be holistic (Zou et al, 2005) and more importantly, it must note the source of the risk (Li and Akintoye, 2003; Zou et al, 2005).

The literature reviewed states that risk will surface at different points of the project cycle (Pantouvakis and Vandoros, 2004; Rwelamila et al, 2003). The risk management process, therefore, enables project players to maximize opportunities while minimizing the consequences of a risk event. According to the Guide to the Project Management Body of Knowledge

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(PMBOK, 1998) risk management in a project consists of risk identification, risk assessment and risk response processes. Risk management is defined as taking deliberate action to shift 'uncertainty' or the odds in the favour of the actors or parties to a contract (Pun-hing, 2003). Inevitably, this means increasing the odds of good outcomes and reducing the odds of bad outcomes. Ceric (2006) stated that risk identification is the most important phase of the risk management process. Guasch's (2004) study of Latin American concessions exemplify how with proper contract design, eventual regulatory framework and coupled with the overall structure of governance, provide the necessary conditions for success. His contention is that concessions would succeed if they are better designed. Guasch's (2004) analysis points out one of the major weaknesses seen in Zambian concessions that have led to inefficiency in PPP contract administration.

The research sought to investigate how effective the introduced PPP law in Zambia was in implementing the earmarked projects. Furthermore the research intended to establish risks and their impacts before, during and after the concession period. It was critical to also analyse the processes in use vis-à-vis their aiding PPP critical success factors during the concession period. Factors affecting the concession period such as risk mitigating instruments were also analysed for their effectiveness. Such inquiry had to be interpreted and then categorized together with given explanations. The level of private sector involvement was also analysed.

4.0 Research Gaps

The following knowledge gaps were identified in the reviewed literature:

(i) the need to investigate what critical success factors influence decisions made regarding risks on PPP projects;
(ii) the need to find out what an effective risk allocation mechanism must achieve to enhance decision making;
(iii) the need to measure the effects of the major risks affecting project phases;
(iv) the need to investigate net present value distribution over the project noting what beneficial effects would be obtained; and
(v) the need to investigate what appropriate risk mitigation methods are applied to successful PPP projects.

5.0 Methodology

Data was collected using structured interviews. Adjustments to the questions were made to ensure that they were qualitatively of an 'open type'. The interviews were designed to re-tell professional experience and interviewees were selected from top management of different key stakeholders. Each interview lasted between 30 and 40 minutes. Extensive notes were taken during the interviews. The spacing of the interviews enhanced establishment of good contact and firm arrangement of dates and venues. Moreover, the spacing of the interviews also helped in the compilation of the information and progressive analysis of the data.

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The interviews were recorded using a digital voice recorder. The recorded interviews were then transcribed. All interviewees were given the list of questions and asked to insert their answers in the spaces provided before the recorded interviews were conducted.

5.1 Analysis of interview results

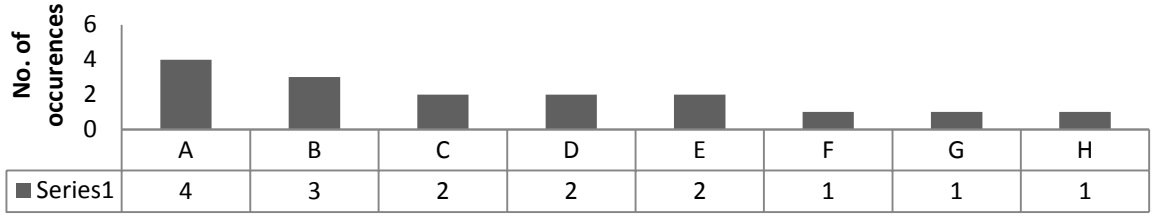
Owing to the fact that PPPs were novel in Zambia at the time of the study, a purposive sample of 10 stakeholder interviewees were selected based on their knowledge of the PPP procurement mode. Four main areas were the focus of the interviews which included critical success factors for PPPs, the risk perception and allocation in the project, investment objectives pursued in projects as well as what financial decision-making tools are used on projects. Descriptive analysis was used on the qualitative data collected (Silverman, 2010).

5.1.1 Background information on respondents

Respondents interviewed held high or middle level positions in their organisations. Four out of the ten were senior managers while five were middle managers. One was a chair person of a private sector organisation. The results show that the interviewees were in positions where they could articulate issues related to PPPs.

5.1.2 Critical Success Factors

Interviewees were asked if the introduced PPP law had helped in the implementation of the projects in Zambia. Out of the ten interviewed, five of the respondents agreed. They were also of the view that without the PPP law, nothing much would have been accomplished. Although many projects were at 'drawing board level', their increase is a sign of developer's confidence in the legal framework. One interviewee was not sure if the introduction of the law has 'had any tangible effect'. Interviewees were asked what would make PPPs to succeed in Zambia and each was able to give two to three responses. A good working structure was mentioned four times while 'delegate work to the private sector' had three occurrences.



A – Good working structure **B** –Delegate work to the private sector
C –Clarity of policy **D** – Publicity or sensitization of PPPs
E –Developing capacities **F** – Thorough PPP knowledge
G – Stable macroeconomic environment **H** – Government guarantees

Figure1: Critical Success Factors

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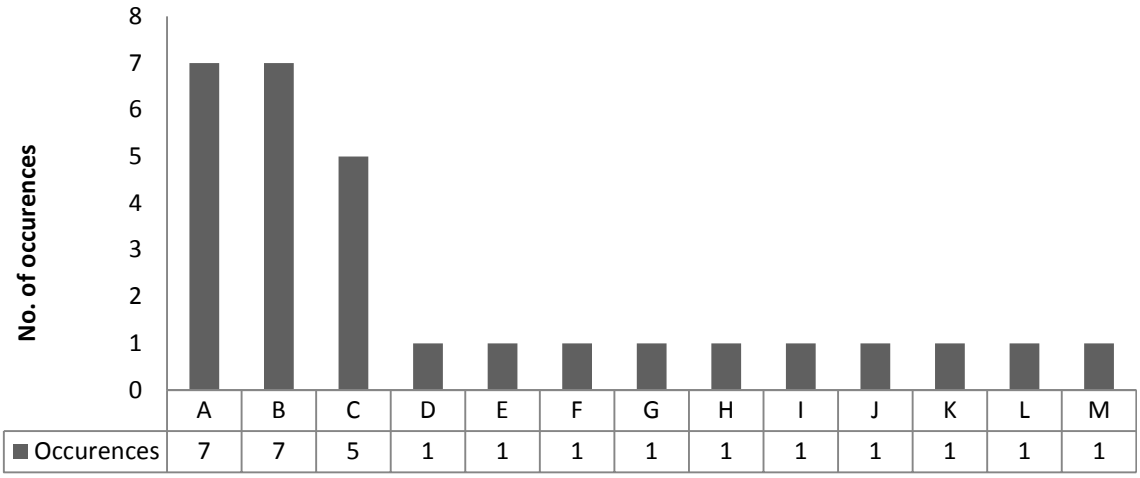
The rest of the critical success factors got single citations from the respondents as shown in Figure 1. Interviewees suggested that a good working structure was necessary for PPPs to be successful. Though a legal framework is in place yet proper procedures seem not to be in place.

Interviewees were asked regarding the understanding of PPP concepts in the Zambian construction industry. There was an affirmative answer from four of the interviewees while two of them responded with an outright 'no'. The other four stated that it 'was doubtful'. This suggests that professionals in the industry are still not clear about PPP concepts.

5.1.3 Risk Perception and Allocation

Interviewees were asked as to which risks would make the implementation of PPPs a difficult task. Thirteen risks were singled out as influencing the Zambian construction industry. Of these, political and high interest risk received seven occurrences, respectively. These were followed by 'lack of consistent policies' which had five occurrences. Ten risks had a single occurrence as shown in Figure 2 denoted by D to M.

On the allocation of risk, interviewees were asked as to how risks should be allocated. Interviewees gave five different responses. 'Government only' bearing the risk as well as 'the best party to handle risk' each had 3 occurrences, respectively. This was followed by the private sector bearing the risk which had 2 occurrences. Sharing risk equally and having risk dealt with in other ways such as engaging a bank, each got a single occurrence from the interviewees.



	A	B	C	D	E	F	G	H	I	J	K	L	M
Occurences	7	7	5	1	1	1	1	1	1	1	1	1	1

A – Political risk **B** – High interest rate risk
C – Lack of consistent economic policies **D** – Foreign exchange risk
E – Global market influences **F** – Land acquisition difficulties
G – Lack of design **H** – Construction coordination risk
I – Force majeure **J** – Social risk
K – Investment risk **L** – Poor governance risk
M – Financial risk

Figure2: Project Risks in Zambia

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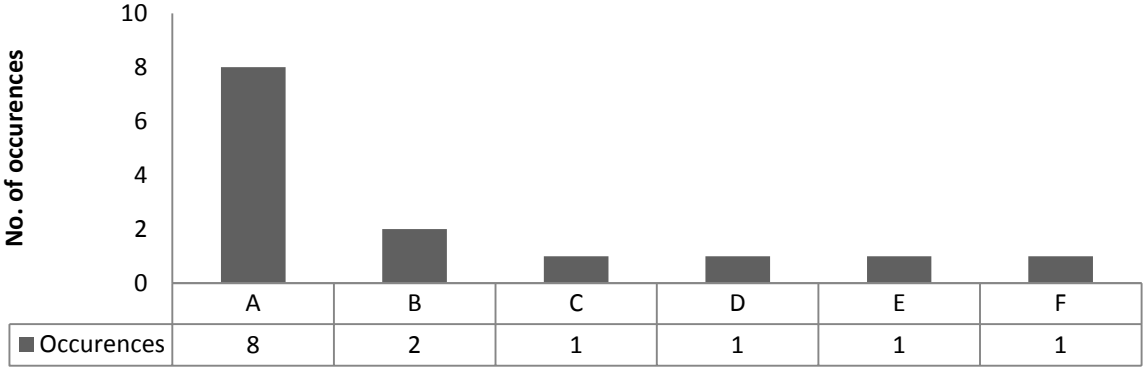
5.1.4 Investment objectives

Investment objectives are themes that PPP projects often follow. Interviewees were asked to state what objectives projects implemented had followed. The pursuit of 'social infrastructure development' had three occurrences. This was followed by the private sector that has a 'profit benefit' receiving five responses from the interviewees. Economic infrastructure was third with four occurrences. Improvement of social and economic infrastructure each had two occurrences while 'business diversification' had one occurrence indicated by the interviewees.

Interviewees were asked if the above stated objectives were aided by the PPP policy and Act No. 14. The number of respondents that agreed that the law had instigated such objectives was four while six stated that they were 'not sure'. There were no responses for those that stated 'no'. Those that had answered 'not sure' did so because they had not read Act No. 14 hence, could not correlate what was happening in the industry with the introduction of the legislation. This suggests that though there is legislation that oversees PPPs, there is lack of understanding of what is involved.

5.1.5 Financial Decision-making tools

Interviewees were asked to indicate which financial decision-making tools had been used on implemented PPP projects. A total number of 6 tools were identified as shown in Figure 3. It was observed that projects applied a combination of decision-making tools. The financial appraisal tool was the most common cited by 8 interviewees. This was followed by cash flow analysis that had two occurrences from respondents. The other decision-making tools used were profit and loss analysis, development concept, cost/benefit analysis and life cycle costing which had a single response each.



A – Financial appraisals
B – Cash flow analysis
C – Profit and loss analysis
D – Development concept
E – Cost benefit analysis
F – Life cycle costing

Figure 3: Financial Decision-making tools

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Respondents were asked on the effects of decision-making on project risk. The effect of using decision-making tools was that it enabled projects to be assessed which received five occurrences. This was followed by 'identification and mitigation of risk' and 'instils trust' that had two responses from the interviewees, respectively. Enhancing decision-making had 1 occurrence. The main effect of decision-making tools was the ability to make informed decisions. Interviewees were asked as to which decision-making tools were considered important for projects by financial institutions. A total number of seven decision-making tools were listed from the responses of the interviewees. Financial appraisals were the preferred decision-making tool by financial institutions as stated by six interviewees. The other utilised tools were the business plan, cash flow analysis, public sector comparator, life cycle costing, equity requirements and assurance of business, each was given a single response.

6.0 Framework for decision-making

The implementation of PPP projects in Zambia has a very lengthy procedure. The process could take periods of one to three years. Cost implications of the procedure will be the future subject of other papers. Decision-making starts from the conceptualisation of the project. The government departments have to give consent starting with the registration of the concept till the final clearance is given by the Office for Promoting Private Power Investment (OPPPI) in the Ministry of Mines, Energy and Water Development as shown in Figure 4 below.

	Private Sector	Decisions	Public Sector
1.	Project concept	Project conceptualisation	(Not involved)
2.		Project specifics	(Not involved)
3.	Project registration	Business plan/authentication	PACRA
4.	Obtaining land	Approach relevant Chief	Min. Of Lands
5.		Getting title for land	Min of Lands
6.	Approach Energy Dept	Seek technical input from technocrats	Min of Energy
7.		Policy adherence/viability	ERB
8.		examined	REA
9.		Study of frame tariffs/Off take agreements	ZESCO
10.		Study environmental impact	MOE
11.	Approach Min of Finance	Declare source of funding	Min of Finance
12.	Obtaining firm commitment	Signing of Memorandum of Understanding	MOE
13.	Obtaining of business applic	Endorsement to sovereign guarantees etc	ZDA
14.		Acquisition of tax exemptions	
15.	Recognition as power provider	Application for operations	OPPPI
16.	Liaison with consultants	Follow up matters on national Power policies	PMRC
17.	Project commencement		

Figure 4: Current decision-making framework for PPP implementation

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The proposed decision-making framework will shorten the current long procedure.

7.0 Conclusion

The adoption of PPPs as a mode of project procurement is a commendable move. However, there is very little understanding of PPP concepts in the construction industry. Political risk was cited as a major factor in the implementation of PPPs. Projects that are being implemented under the PPP mode are following notable investment objectives. Those utilising this mode of procurement are aware of the necessity of using financial decision-making tools. It appears that professionals in the construction industry, though aware of the introduced law, have not read it at all. Finally, the current decision-making framework leans heavily with government technocrats. The decision-making framework is undergoing modification in my research.

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LACK OF WATER SERVICE DELIVERY IN NORTH WEST PROVINCE RAMOTSHERE-MOILOA LOCAL MUNICIPALITY

Daw, D.O.[1] and Mosife, P. D.[2]

Abstract

Conceptually the term public service is broadly used and means different things to different people and in different contexts (Baloyi, 2010). This leads to confusion regarding what a public service really is as opposed to a service that does not form part of the responsibilities of government such as a business transaction. The confusion comes in where people are unable to distinguish between a service that are entitled to at the expense of government and one that requires personal commitment. Municipalities are constitutionally obliged to make sure that people in their areas have at least the basic services they need in order to live a healthy live such as, water supply , sewage collection and disposal, refuse collection, health services, roads and storm drainage, electricity supply, education , street lights, parks and recreational facilities. This paper looks at water service delivery at Ramotshere-Moiloa local municipality.

Key Words: Water, Municipality, Service delivery

1.0 Introduction

South Africa is characterized by both achievements and challenges. After the end of apartheid, the newly elected government was left with huge services backlogs. The government made a strong commitment to high service standards and better living for all South Africans. Since then, the country made progress with regards to improving living standard of many people and providing other services. Therefore, as years went by the delivery of service declined and now South Africa is faced with the challenges of service delivery in all spheres of government.

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The emergence of the new South African democracy in 1994 brought with it expectations of equalisation across racial, gender, socio-economic and geographic boundaries; fair and just delivery of services; access to basic services; and hope that all citizens could own their freedom and dignity. The Reconstruction and Development Programme (RDP) 1994, in an attempt to redress South Africa's skewed water resource and service legacy, recognised the right of all South Africans to access clean water and adequate sanitation for the attainment of household water security. Water is critical for the promotion of health and hygiene. The right to access water, as stated in the RDP, was translated into national legal obligations, which were reflected in the South African Constitution 1996, under section 27 (1) (b), which states that, "everyone has the right to have access to sufficient ... water" (Republic of South Africa (RSA), 1996). Commensurate with the legislative obligations, as issued in the 1996 Constitution, the Water Services Act 1997 was adopted as a necessary measure to ensure an implementation framework to "provide for the rights of access to basic water supply and basic sanitation" (RSA, 1997). The "sufficient" volume of water referred to in the Bill of Rights (RSA, 1996) was re-worded as "basic" and defined as the "prescribed minimum standard" of water supply services necessary for the reliable supply of a sufficient quantity and quality of water to households to support life and personal hygiene (RSA, 1997). The minimum standard for basic water supply services, as provided by the Water Services Act 1997 is:

- "the provision of appropriate education in respect of effective water use; and
- a minimum quantity of potable water of 25 liters per person per day or 6 kiloliter per household per month. Within 200 m of a household" (RSA, 1997).

As the Municipal Systems Act also support the Constitution in water access, as chapter 8, 73. (1) (a) states that municipalities must "give priority to the basic needs of the local community", and (1) (c) states that municipalities must "ensure that all members of the local community have access to at least the 50 minimum level of basic municipal services. The South African constitution guarantees all people the right to access adequate and affordable potable water to meet basic domestic needs; and "water and sanitation services should be delivered equitably, affordably, effectively, efficiently, sustainably and gender sensitively to satisfy sector goals" (Republic of South Africa (RSA), 1996; Department of Water Affairs and Forestry (DWAF), 2003).

On the 1st February 2001, a basic supply of free water was extended to all household in the implementation of Free Basic Water Policy, however the primary target of the free basic water policy was aim for poor households for whom free basic services represent a significant poverty alleviation measure and poor households would benefit the most from an affordable basic water supply. The extension of free basic water to poor households was recognized by government, as a significant poverty alleviation measure, with positive implications for public health, gender and equity. The volume of water offered through the free basic water policy is recommended as 6 kiloliter/ 6 000 liter of potable water per household per month. 6 kiloliter of free basic water is delivered per household per month, via individual metered connections. This is commensurate with the Water Service Act (1997), which states the minimum standard for basic water supply

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services as a “minimum quantity of potable water of 25 liter per person per day or 6 kiloliter per household per month … within 200 m of a household” (RSA, 1997: paragraph 475). The free basic water policy is driven by the national Department of Water Affairs and Forestry but set and implemented by local governments. The free basic water policy states that “the provision of the basic amount consumed by poor households per month is free of charge” however, the policy allows local governments through their ‘water services authorities to decide how they will apply the policy specifically and practically’ (DWAF, 2003:29). Municipalities have three options when deciding how to implement the free basic water policy:

- Provide free allocation of water just to the poor free of charge (i.e. targeted);
- Provide a free allocation of water to everyone free of charge; or
- Provide a free allocation of water to everyone free of charge but if domestic users consume more than the free allocation than they must pay for the free charge.

1.1 North West Province

North West is divided into the central, Bophirima (towards the east), Southern, Rustenburg and Eastern regions. These regions are now changed into district namely; Ngaka Modiri Molema District, Bophirima District; Dr Ruth Segomotsi Mompati and Dr Kenneth Kaunda. Most economic activity is concentrated in the Southern region (between Potchefstroom and Klerksdorp), Rustenburg and Eastern region, where more than 83,3% of GDPR of the province is generated (South African Year Book 2007/2008).

Ngaka Modiri Molema District Municipality, The District is home to Mafikeng, the capital of the province. Aptly named, the slogan of the capital is ‘the city of Goodwill’. The district municipality (DC38) is situated centrally within the North West Province. The principal towns in the region include Mafikeng-Mmabatho, Zeerust and Lichtenburg. It consists of the five local municipalities, namely; Mafikeng, Ratlou, Ramotshere Moiloa, Ditsobotla and Tswaing. The five local municipalities are subdivided into wards as follows: Mafikeng LM – 28 wards, Ditsobotla LM – 19 wards, Ramotshere Moiloa LM – 17 wards, Tswaing LM – 13 wards, Ratlou LM – 12 wards (NMMDM’s IDP 2011/2012). Section 84 of the Municipal Structures Act No. 117 of 1998 regulates clearly the functions and powers of District and Local municipalities.

The **Ramotshere Moiloa local municipality** (RMLM) is located in the northern part of the country, within the North West Province and the Ngaka Modiri Molema District Municipality. After the democratic dispensation in 1994, the name of the municipality-Zeerust was changed to Ramotshere Moiloa. The Municipality measure a total are of 719.6 square meters and it shares boards with Botswana in the North, Moses Kotane and Kgetleng River local municipalities in the east and Ditsobotla and Mafikeng in the South Botswana. The geographical area of Ramotshere Moiloa is predominantly rural including considerable land under the traditional authorities. The vast majority of the population lives in a rural or peri-urban environment, which for the most part is unplanned and poorly unserviced. Development of Ramotshere Moiloa itself is constrained by prominent hills (mountains) that run in the east-west direction, the RMLM as part of the NMMDM is primarily. Characterised by turf from veldt and mixed bush veldt areas. Other constraints to the development planning of the RMLM are lack of information, which is critically important for

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the planning of the area. There is also a complete lack of maps for the settlements that constitute the municipality. The municipality is characterized by a few urban areas including Zeerust town, Ikageleng, Henry Ville, Olienhout park, Shalimar park, Welbedacht (Lehurutshe town) and Groot Marico. The rural part of the municipality is estimated at 70% with over 40 villages which stretches up to 120 KM (RMLM IDP 2011 – 2012). The town is a commercial hub for most of the villages situated in the Lehurutshe area, a few of which include; Lekgophung, Supingstad, Serake, Rietpan, Motswedi, Dinokana, Lekubu, Mosweu, Ntsweletsoku, Mokgola, Borakalalo and Gopane.

2.0 Determinants of Water Demand

- Population,

People's dependency on water means that the demand for water is determined by population growth. The South African population grows rapidly now a day. This means the demand for water increases as population increase. More water will be required to meet the needs of this larger population because water is essential for the lives.

- Rate of urbanisation

Not only is South African population increasing rapidly, but the rate of urbanisation is high too. Urbanisation is water intensive. It results in concentration of people who make special demands on the availability of water. Urbanisation is usually accompanied by the installation of waterborne sewerage, which significantly increase the amount of water used.

- Rise in standard of living

Economic development and rise in the living standards results in an increase in the amount of water used. People who have houses, gardens and running water use more water than poor people who have to carry or transport water themselves from outside their yard. Therefore, increased living standards increase the consumption of water.

- Industrial development

Industries use more water. Industrial development in South Africa makes the great demands on the available water resources. The nature on industrial development also has an effect on water use. Large, capital-intensive industries such as basic metals and paper manufacturers use more water than smaller, labor-intensive industries. This has a considerably effect on water demand.

- Agricultural development

Continued agricultural development certainly increases the demand for water. Improved irrigation techniques and the use of improved cultivars for dry land farming are expected to relieve the pressures on water for agricultural purposes. Nevertheless, the demand for water for irrigation and stock-watering will increase.

3.0 Management of water resources

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There are two sources for the provision of water, namely surface and subterranean water, the most important source is surface water, which flows in rivers and is stored in dams, Water resources management is very essential, the following measures can be used as management of water resources

- Efficient storing

The building of dams is required if river water is to be utilised; otherwise a large percentage of this water would flow into the sea and not be available for economic use. Many dams have been built in South Africa between the years. The commission felt that efficient storage of water would be promoted if all possible locations for new dams were carefully identified, advanced management system in the managing of dams were used, and a limit were imposed on the small farm dams which simply increase evaporation.

- Reduction of evaporation

It has been estimated that, on average, 27 percent of the content of South Africa's dams is lost through evaporation. This can be prevented by constructing underground storage facilities, positioning dams correctly, with the emphasis on depth and small surfaces, and spraying chemicals on the surface of the water to prevent evaporation.

- Catchment Management Strategies

These strategies are developed locally in catchment management areas, following consultation, to set principles for allocating water for existing and new water users, to provide the framework for managing water resources within the catchment management area; and to ensure that water resources are protected, used, develop, conserved, managed and controlled.

- Flood control

Although this is generally not a big problem in South Africa, floods have caused extensive damage in occasion. Control of floods water will increase the quantity of water which can be used and also delay the silting up of natural storage sites.

- Recycling of water

The recycling of water is a strong possibility, particularly for industrial use. According to the Commission of Inquiry into Water Affairs, recirculation can reduce the use of fresh water in factories by between 50 and 90 percent. Stricter control is needed for recycling of water for household use, but experience in cities has indicated that water from sewage can be purified so that it is suitable for human consumption.

- Combating pollution

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If pollution of South Africa's rivers by industries, agriculture and urban sewage could be combated, the availability of usable water would be increased. This means that stricter control measures (Emission fee) and monitoring are required.

- Pricing Strategy

This strategy is established by the Minister with the concurrence of the Ministry of Finance to address the overall strategy to set water use charges to cover the cost involved in developing and managing the water resource so that it is protected and conserved for beneficial use.

4.0 Water Resource in Ramotshere Moiloa Local Municipality

Water resource management is the key issue for Ramotshere Moiloa Local Municipality. Not only is this water scarce area, but various special water features such also as: pans and dolomite eyes occur and needs to be protected. The transfer of water to Botswana is an issue which raises discontent. The possibility of using that water for local development is also a possible strategy to increase water availability in the area. RMLM forms part of the Limpopo-Olifants drainage system and all its rivers and tributaries drain northward. One of the two bigger rivers, the Marico River of which the western tributaries stretch into Lehurutshe drains into the Limpopo River, and the other the Notwane River, drains into Botswana. This region is part of the major recently demarcated Crocodile (West) Marico Catchment, RMLM source of water are following:

(a) Molatedi-Gaborone Water Supply scheme is located in the extreme northern parts of the Zeerust Local Municipality. This scheme provides water to the Derdepoort and Kopfontein border post communities through local water treatments at both these settlements. It also supplies water to Gaborone in Botswana.

(b) Ngotwane Water Supply scheme is located in the Ramotshere Moiloa Local Municipality within the NMMDM. This scheme provides water to the communities of Ga-Seane, Lobatleng, Makgeapana, (Rietgat), Tsholofelo and Driefontein. The total number of households serviced by this water scheme is approximately 2000.

(c) Motswedi Water Supply scheme is located in the Ramotshere Moiloa Local Municipality. It abstracts water from the Sehujwane Dam thereafter water is treated at the Motswedi water treatment works. This scheme supplies water to the communities of Reagile, Borakalelo, Gopane East, Gopane West and Sebalagane. The total number of households serviced by this water supply scheme is approximately 4 480.

(d) **Groundwater**

* In Lehurutshe groundwater constitutes the most reliable and major water resource. A large reservoir of subterranean water, in the form of fractured aquifers and dolomitic compartments, occurs in the Lehurutshe district and parts of the district (e.g. Dinokana, Braklaagte and Serake in the South-West and Supingstad in the North) have hydrogeological potential. Since the aquifers are semi-confined, the pressure in the

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aquifer exceeds that of the general air pressure outside and causes groundwater to rise in a borehole or spring.

- Although the chemical composition of the groundwater may not be optimal for domestic use and successful livestock production (Area Sustainable Social Development-Research), groundwater is of critical importance for rural communities in the drier regions and often the only available water resource (Sarone Van Niekerk 1 and Kobus Du Pisani2*). Inhabitants of several villages (e.g. Dinokana, Lehurutshe, Mosweu, Ntsweletsoku, Gopane, Witkleigat, Serake and Supingstad) rely on either dolomitic eyes or borehole water for human consumption and stock-watering. Pumping more groundwater from the northern compartments of the Zeerust/Mafikeng/Lichtenburg dolomitic series into the Lehurutshe district has been considered by Department of water and forest Affairs.
- There is difference of opinion about the recharge rate of groundwater in this district, but it seems to be generally rather low. The recharge rate of the Dinokana, Braklaagte and Serake aquifers is approximately 8.1 to 32.0 mm/a, but the recharge rates of the other Lehurutshe aquifers are uncertain. Currently, detailed studies that will reveal the available yields of the aquifers, ascertain the effects of tapping from groundwater resources on the physical and socio-economic environment of the region, as well as determine how to sustain the balance between linked aquifers, are under way.

4.1 Water supply in Ramotshere-Moiloa

Water provides in Ramotshere Moiloa Local Municipality are municipality and Botshelo Water. Most of the residents get their water supplied by municipality 70% Botshelo Water just supplied only 30% of the residents.

There are different source of water where people can get water from. At RMLM people get water from four different sources namely: tap inside house, tap inside dwelling community stand and water tanks. above 22.5 of the people at RMLM access water from taps inside their house. 35% access water from taps inside dwellings or yard. 30% of the residents get there from community stand while 12.5% uses water tanks as their source. And most of the people who use water tanks are those residing at Mosweu.

According to the FBW policy/act one of the conditions is that a travelling distance that people travel to get their water must not be more than 200 meter, 62, 5% of the population travel the distance of less than 200 meter as most of them has taps inside house and dwelling. 15% of the population travel a distance of 200 meter to community stand and water tank. Then 22,5% travel a distance of more than 200 meter to community stands and water tanks. This is because you find one community stand or water tank in the village being used by too many household and it is far from other household.

Challenges that residents experience in accessing water: 25% of the population experiences no challenges but 75% of the population experiences various challenges. Most

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common challenges have to stay for more than 2 days to a week or two weeks without water. Those with water tanks complains that they have two wait for a long time waiting for one another as the lines are long and this is as a results of many household using one water tank and they have to clean tanks themselves. The distance that some have to travel is unbearable as it is over 200 meter. They complain that the pipes are old and rotten and they constantly burst. They need to always have cash which is impossible so that when there is water cut off they can always go to those with borehole and buy water or buy water from stores and that can be a big challenge to those with low income. Challenges faced the population tell us that there is a problem with water supplied. It alerts us that between municipality and Botshelo water neither one nor both are not doing their job and responsibility.

The mode of transport that people use to get water: 42.5% uses wheelbarrow to get water when it is outside yard. 2.5% uses cars because the distance is more than 200 meters from their places and they get their water from water tanks and community stand pipes. And 55% do not travel as they have water inside house or yard.

The quality of water according to the answers of the community: 42.5% of the population says that the quality of water is good. 52.5% says that it varies; some time is good and clean but, sometimes it is not clean and clear and the taste is bad. And 5% says the quality is bad, especially those who use water tanks as the municipality does not take care of tanks cleaning and some residents through all sought of things inside the tanks, e.g. baby nappies, pads and so on.

Knowledge or information that the community has about free basic water: 62.5% of the population has no idea about Free Basic Water. Then 37.5% do know or at least have information about FBW. But out of these 37.5% some are of them were given wrong information. One of the ladies from Ntsoeletsoku said they were told that they should get 6 kiloliters of water free of charge for the only three first months.

The duration that it takes municipality to respond to complains: it might be water cut off or technical complains. 22.5% says it takes 2 day, meaning that they comply with the policy as the policy states that they should respond within 24 hours. 35% says it take two days to a week which is a bit unacceptable but municipality justifies it by saying they don't have enough resource and they are short staffed. 22.5% have to wait for 2 weeks for response and the justification other than the one above is that they work in many villages and when they delay is because they are still busy in other villages. 30% waits for a month and that is a long period a person has to stay without water. Municipality says this happens because they sometimes don't have material to carry their duties and suppliers also take a long time to supply them with material.

The periods it takes municipality to pour water in water tanks placed in villages: 17.5% of the population says it pours water twice a week which is satisfying. Another 17.5% says it pours water once a week and it is still reasonable. 5% claims that water is pour twice a month, this can sometime not be enough depending on the number of household accessing water from that tank and their size of households. 15% says that water is only poured once a month which is not

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acceptable to community as that water finishes in the middle of the month and they have to wait for the next month. And in the meantime while they are waiting they suffer because they have to buy water from those with borehole or those with taps inside yard. And some of these people can't afford to buy water as their income levels are low.

Water management resources or strategies that municipality use to absorb and to safe water. Municipality has reservoirs making 52.5%. 2.5% represents dams that the municipality has. Meters make up 42.5% even though some of the meters are not working as results of electricity pole where inserted and mistakenly they broke meter pipes underneath and municipality never took initiatives to repair those pipes. So basically meters are not effectively working so water is lost and wasted because people can misuse water. 2.5% is for other water resources specified like community placing their own tanks at house to absorb rain water.

5.0 Findings of The Study

Based on the assessment and the analysis, the study has the following findings:

- There is a serious need to strengthen communication between community and municipality concerning cut off of water if there is going to be a cut off. They should copy do should inform community members at least a day or two days before.
- Majority off community members do not know anything about Free Basic Water (FBW) and some of the community members who knows something, have wrong information. Municipality should be transparent and give people correct information about national grants and their conditions since FBW is a grant and financed by national fund not municipal funds.
- There is a problem of unemployment in the country as a whole and yet you still find that some institution experiences a problem of being short staffed even though there are grants and funds to build capacity in our municipality. Meaning that there is no full utilization of resource. Municipality need to hire more staff to overcome the problem of water.
- According to my findings, majority of the community agree that there is enough budgets for water service delivery but their argument is that it is not used for its purpose or according to its conditions. There is a need for monitoring of conditional grants and projects or tenders awarded starting pricing, quality of material etc. to make sure that delivery is prioritized.
- Municipality must rework management strategies, because one of the strategies is pricing water through inserting meters for the beneficial use of the community and to avoid misuse of water, the current situation with Ramotshere Moiloa Local Municipality is that their meters are not functional in lot of the areas, therefore, people are basically accessing free water, and these free water that they are accessing is not the water we referred to in FBW.
- Some of the areas in Ramotshere Moiloa are dry areas or characterized by mountains and stones, it therefore becomes harder to access ground water.

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- Water is essential for human survival, but most importantly clean water, Ramotshere Moiloa Local Municipality must come up with means to improve the quality of water because the quality of water there is not satisfactory.
- The district municipality is supporting Ramotshere Moiloa in supplying water since they are the water authority.

5.1 Recommendations

It is evident that most of community members are not satisfied with municipal services when coming to water. There is lack of water service delivery in this municipality and in order to combat these challenges the following are recommended:

- The results suggest that the municipality of Ramotshere Moiloa must hire more staff for effectiveness of water supply to the society. The municipality must consider this suggestion as water is an essential need for daily purpose of life.
- One supplier of water is needed to increase effective responsibility.
- Water meters must be repaired and put in to place as a strategic measure to safe water.
- Water budget monitored correctly so that it is used to address water related matters only.
- Municipality must increase their communication relation with the community and make sure that the community is aware of their challenge.
- Free Basic Water was implemented with the idea of trying to solve problems of water in the country and to eradicate poverty by improving people's standard of living. There its implementation by municipalities should transparent and its conditions should be known by community members through accessing correct information from the municipality.
- Water service delivery causes poverty as the travelling distance that people travelling is far from home and are so many water illnesses that result from lack water delivery and the standard of living as a result is low.

6.0 Conclusion

The main objectives of the study were to find the cause of lack of water service delivery in Ramotshere Moiloa Local Municipality within Ngaka Modiri Molema district. Based on the assessment and the analysis, the study found that most of the challenges and constraints for water delivery lie with the municipality. The study found that the standard of capability and work quality of municipality is poor. Even with so many government grants that assist municipalities to build capacity, the quality of municipalities' service delivery has not improved because municipalities are dominated by political power and nepotism. Grants allocated for water service delivery (e.g. DWAF or WSOG) are not fully utilized for the purpose of water delivery, even though at the end money allocated is finished with over spending sometimes, National and provincial government should come up with strict measure to combat issues of corruption in municipalities so that there can be effective and efficient service delivery and to build a better nation for all who live in this country.

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FACTORS AFFECTING CONSTRUCTION UNIT RATES IN THE ZAMBIAN ROAD SECTOR

Balimu Mwiya[1], Mundia Muya[2], Chabota Kaliba[3] and Peter Mukalula[4]

Abstract

It is perceived by stakeholders that Zambia does not always get value for money in infrastructure delivery. Industry regulators and public institutions have indicated that there was a notable trend in varying costs of construction from project to project and from one public institution to another, that it had become increasingly difficult to ascertain the true cost of projects and thereby unable to guarantee value for money (ZPPA, 2014). The national roads system in Zambia is experiencing a period of exceptional activity following large increase in public spending in the sector to improve and enhance efficiency of transport infrastructure. It is therefore important for key stakeholders to have an informed decision on prevailing market rates and how they are determined.

The main objective of the study was to investigate the difference between actual direct costs and prevailing market rates in infrastructure delivery. This difference referred to as the 'economic strata' or 'cost structure' reflects the peculiarities of the local setting usually qualitative in nature such as prevailing project conditions, competition and other risk factors.

The study reported in this paper was aimed at selecting and assessing factors that account for cost variations across road construction projects in Zambia to be incorporated into a Unit Cost Estimation Model (UCEM). Through expert interviews, it was established that major cost factors in road construction were mainly due to location, haulage distance, delayed payments and quality of project management. Of interest were factors such as political risk, advance payment and type of project consultant that were anticipated to have a major effect but which results revealed had little or no effect.

Key words: construction unit rates, unit cost estimation model, road works, cost factors, Zambian construction industry

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Understanding cost factors is the first step in the development of a UCEM that can be used in determining the make-up of prevailing market rates thus addressing Zambia's perceived high infrastructure costs.

1.0 Introduction

It is perceived by stakeholders that Zambia does not always get value for money in infrastructure delivery. Major stakeholders such as the National Council for Construction (NCC), the Zambia Public Procurement Authority (ZPPA), the National Road Fund Agency (NRFA) and the Road Development Agency (RDA) have in the recent past called for an informed position on prevailing market rates in the Zambian construction industry. ZPPA (2014) stated that there was a notable trend in varying costs of construction from project to project and from one public institution to another, that it had become increasingly difficult to ascertain the true cost of projects and thereby unable to guarantee value for money. NCC (2010) stated that it was understandable for rates to rise as certain costs such fuels and other inputs that go into construction works rise, however the rise in the costs had been too drastic for the Zambian industry. In the absence of construction indices, there was need to establish guidelines on factors that influence the determination of rates in the Zambian construction industry.

The national roads system in Zambia is experiencing a period of exceptional activity following large increase in public spending in the sector to improve and enhance efficiency of transport infrastructure. In September 2012, Zambia made her inaugural entry on the international capital market and raised US $750 million, at a price that is one of the lowest ever for a debut issue for a Sub-Sahara African country. US $430 million (57%) of the Eurobond was budgeted for road and rail transport (GRZ, 2013).

Though the underlying production technology of road construction is similar, the cost structure of the services varies. To understand whether the existing road sector is operating efficiently and whether it can handle the rising changes successfully, there was need for the RDA as custodian of roads in Zambia to appreciate the cost structure of the industry. Malmsten (2008) stated that to capture the cost structure of an industry is not necessarily the same as to capture the actual costs raised by the system. The difference between actual direct costs and prevailing market cost is referred to as the "economic strata".

This paper identifies cost factors to be used to measure the "monetary behaviours" of cost estimation in infrastructure delivery. Roughly determining the economic strata of a process involves understanding the unit costs of the whole process, and characterizing how resources are allocated and how they scale with size of the task. Though factors that affect road construction cost are more or less the same worldwide, it is the impact or effect that varies and makes it unique to a particular sector or country. It is therefore imperative that the economic strata of a system be analysed in order to assess efficiencies and inefficiencies in the system.

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2.0 Literature review

Cost estimating is essentially a computational process that attempts to predict the final cost of a future project, even though not all of the parameters and conditions are known when the cost estimate is prepared (AACE, 2013). In general, estimating methods vary considerably, depending upon the available information, the nature of the project, and the time available to prepare the estimate. The most common approach to cost estimation used in Zambia is unit costs for bill of quantities. Hendrickson (2008) describes the unit cost estimation approach as, where a unit cost is assigned to each task as represented by the bill of quantities and the total cost is the summation of the products of the quantities multiplied by the corresponding unit costs. A study carried out by Mashilipa (2004) investigated various cost estimation methods used in the Zambia construction industry. It revealed that the most common method was the use of rates based on past contracts with an allowance for inflation followed by building up of unit rates from first principles and finally use of computer software. Mashilipa (2004) observed that use of previous tender rates was common because of lack of experienced cost estimators in the bidding firms and the reduced duration of coming up with an estimate. This trend in Zambia indicated that estimate accuracy was the least requirement by the bidders. This was further compounded by the fact that the Surveyors Institute of Zambia does not have guidelines on cost estimate accuracy as established by professional quantity surveying bodies in other countries.

The consequences of an ill-defined cost estimation system is demonstrated below in a project carried out in 2011 involving 31.1 Km of urban roads on the Copperbelt, Zambia known as the Formula 1 Lot 4. Summary of the bids received is shown in Table 1.

Table 1: Formula 1 Lot 4 Bid Summary

S/No.	Name	Total sum in ZMW	Project rate per km
1.	Contractor A	75,623,454.16	2,431,622.32
2.	Contractor B	89,723,044.16	2,884,985.34
3.	Contractor C	198,509,008.27	6,382,926.31

It was astounding that the difference in bids was as high as 162%. Even the second lowest bidder was 16% above the lowest bidder. Further examination of the unit prices for different work items revealed even larger disparities of around 2000%. Table 2 shows unit rates for selected items that showed huge disparities.

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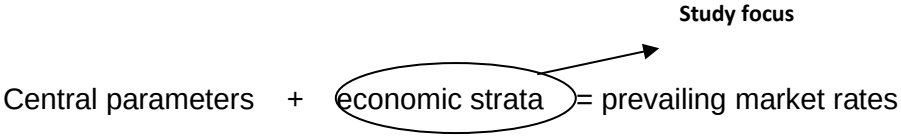
Table 2: Unit Prices with huge disparities in Formula 1 Lot 4 Bids

S/No	Description	Unit	Rate 'ZMW		
			A	B	C
1.	150mm compacted pavement layer	m3	45.76	105.00	147.00
2.	crushed stone base	m3	10.00	222.50	36.75
3.	road-marking: white lines	Km	2,788.50	8,866.50	14,700.00

A review of literature showed that there was no single approach to developing construction unit rates (CUR). Generally, road construction works can be considered as a combination of two types of items. Firstly, those that can be estimated through some form of calculation, for example, the direct labour, material and equipment inputs. In this category the cost relationships between labour, material and plant are known. Secondly, items cannot be calculated directly. The difference between actual direct costs and prevailing market rates is referred to as the 'economic strata' or 'cost structure' which reflects the peculiarities of the local setting usually qualitative in nature such as prevailing project conditions, competition and other risk factors.



Formula 1: Mathematical representation of area of study

There are various unit rate build up software available which accurately estimate the direct costs and usually allow a percentage mark-up to accommodate the economic strata.

The study focuses on understanding the factors that make up the economic strata of road works in Zambia. Blocher et al. (2008) stated that in cost estimation choosing cost drivers was the most important step since the model's accuracy was based upon selecting the relevant and appropriate cost drivers. Literature identifies various factors that affect construction cost with varying impacts in different parts of the world. Table 3 summarises some of the top ten factors influencing cost estimation in different countries.

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Table 3: Top ten factors influencing cost estimation in different countries.

Author	Enshassi et al. (2007)	Memon et al. (2010)	Elinwa AU and Buba SA. (1993)	Trombka Aron and Sarah Downey (2008)
Title	Contractors' Perspectives towards Factors Affecting Cost Estimation in Palestine	Factors Affecting Construction Cost Performance in Project Management Projects: Case of Mara Large Projects (Malaysia)	Construction cost factors in Nigeria	A Study of County Road Project Cost and Schedule Estimates
Factors	1. Location of project (hot areas) 2. Segmentation of Gaza strip 3. Closure of Gaza strip 4. Financial status of the owner 5. Increase in unit costs of construction materials 6. Experience of consultant engineer 7. Clarity and quality of drawings before tendering 8. Clarity and accuracy of information related to the project before execution 9. Number and classification of competitors in tendering 10. Tender's currency	1. Fluctuation in prices of materials 2. Cash flow and financial difficulties faced by contractors 3.Shortage of site workers 4. Lack of communication among parties 5. Incorrect planning and scheduling by contractors 6. Contractor's poor site management and supervision 7. Delay in Material procurement 8. Underestimate project duration resulting Schedule Delay 9. Unforeseen ground conditions 10. Low speed of decisions making	1. shortage of materials 2. financing methods and payments for completed works 3.poor contract management, 4. materials cost 5. fraudulent practices and kickbacks 6. the fluctuation of material prices	1. Project Scope: 2. Land Acquisition: 3. Utility Relocation: 4. Laws, Regulations, and Policies 5. Environmental Compliance: 6. Surrounding Development: 7. Nearby Road Projects: 8. Cost Increases/Inflation: 9. Fiscal Conditions: 10. Procurement Process:

From Table 3, the factors reveal an insight into the construction economic strata of the different countries. In Palestine, closure and blockade of borders indicate security concerns contractors experience where as in the United States of America utility relocation is a major factor due to the developed nature of the country. Whereas fluctuation in prices of materials is a major factor in Malaysia, it is the shortage of materials that affect construction cost the most in Nigeria. In

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addition, the inclusion of corruption as a factor in indicates an issue contractors have to deal with in Nigeria.

It can be deduced from literature that periodic review of cost factors was essential because of countries constant political, economic social and technological transformation.

The determination of cost factors in the Zambian road sector forms the basis of the UCEM to be developed using neural networks (NN). Though there is no limit on the number of factors or variables to be used in NN, Bode (1999) stated that the number of attributes assumed to have an effect on cost should be small because the architectural complexity increases with the number of attributes, requiring more training samples to reach a given accuracy, yet training samples were usually scarce in cost estimation. From literature review, the number of influencing factors used in similar studies in NN is indicated in Table 4. Table 4 indicates an average of 9.9 factors.

Table 4: Number of input cost factors for Neural Networks

S/No.	Author	Topic	Number of cost factors used
1.	Peško et al., 2013	A preliminary estimate of time and cost in urban road construction using neural networks	9
2.	Hasan Abu Jamous (2013)	Parametric Cost Estimation of Road Projects Using Artificial Neural Networks	9
3.	Muqeem et al., 2011	Construction labour production rates modelling using artificial neural network	5
4.	Krzysztof Schabowicz & Bozena Hola (2007)	Mathematical-neural model for assessing productivity of earthmoving machinery	5
5.	Emsley et al., 2002	Data modelling and the application of a neural network approach to the prediction of total construction costs	Network 1 – 5 Network 2 – 9 Network 3 – 41
6.	Hashem Al-Tabtabai et al., 1999	Preliminary cost estimation of highway construction using neural networks	9
7.	Moselhi and Siqueira, 1998	Neural networks for cost estimating of structural steel buildings	4
8.	Ayed, 1997	Parametric cost estimating of highway projects using neural networks	10
9.	Creese and Li, 1995	Cost estimation of timber bridges using neural networks	3

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From literature review, cost factors which affect unit costs were selected and divided into four categories country, road sector, contractor and project specific as presented in Table 5.

Table 5: Selected cost factors from literature review

Country specific: (for comparison with other countries) Country classification, Human Development Index (HDI), The Global competitive index (GCI), Ease of doing business, Corruption Perception Index, Gross Domestic Product, Total road network (km), Road density (km of road per 100 sq. km of land area), Total % of paved roads
Road Sector specific: (includes regulations and policies imposed by road sector regulators) Land acquisition, Project need, delayed payment, Contract financing or financial assessment, political risk, advance payment provisions, 20% subcontracting, HIV training, project consultant, Project planning and management, quality of bidding documents, Price adjustment clause, Contractor selection method, Road type, Exchange rate, Material shortages, Material Source, Competition, environmental (EIA) project site restoration,
Contractor Specific: Contractor size, Contractor type, Labour, Equipment availability, contractor cash flow, Overhead & Profit
Project Specific: road length, Duration, Year, Project scope, Culvert crossings, Location, Hauling distance, Detour, Utilities, Soil condition, Climate,

3.0 Methodology

The research methodology in the reported study evolved around the need to establish the cost factors to be incorporated in the UCEM. From literature review various factors that influence unit rates in road works were identified. In all previous studies, the selection of cost factors was dependant on the experience and expertise of industry professionals. A number of techniques were available to acquire tacit knowledge based on the expertise of construction specialists such as Delphi, nominal group technique and or expert interviews.

In a study by Hashem Al- Tabtabai et al. (1999), factors were selected based on interviews by five 5 industry experts. Interviews were adopted as a means of data collection. Structured interviews were conducted between February and May 2014. The interviews targeted ten professionals comprising five civil engineers and five quantity surveyors with experience in costing of road works in Zambia.

4.0 Survey results

4.1 Profiles of interviewees and their firms

Seven out of the targeted ten professionals participated in the interviews. Out of the seven interviewees, five had over twenty years of experience in infrastructure estimating while the other two interviewees had between ten and fifteen years of experience. All interviewees held management positions within their organisations.

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4.2 Influencing factors

Interviewees were asked questions regarding the impact of cost factors on unit rates based on the Likert scale of 1 to 5 where 1 means no impact and 5 means extremely high impact. Analysis was done using SPSS. The factor analysis could not be used as the dataset of seven interviewees was too small. Analysis using descriptive statistics was adopted. The sum and mean statistics were used to categorise factors in quartiles as shown in Table 6, where the first quartile represented factors with the highest impact and those with the lowest influence in the fourth quartile.

Table 6: Ranking of cost factors categorised in quartiles

1st quartile:	**2nd quartile:**
location hauling distance Delayed payment Project planning and management Material Source Equipment availability Project need Exchange Rate Contractor type duration Project scope	detour Contract financing labour contractor cash flow political risk soil type contractor selection method Material Shortages Contractor size Overhead & Profit Corruption Perception Index
3rd quartile:	**4th quartile:**
Quality of bidding documents utilities Culvert Crossing climate Ease of doing business Price adjustment clause Country classification The Global competitive index Land acquisition Road Type Competition	Road length Gross Domestic Product Total road network Advance payment Human Development Index environmental (EIA) project site restoration, Project Consultant Total % of paved roads year 20% subcontracting HIV training, Road Density

5.0 Findings

5.1 Location

All interviewees agreed that location was a major factor in bidding for contracts. Further query from an interviewee revealed that mobilisation costs were about 10% higher for areas such as Shangombo which is close to 900 kilometres from Lusaka and considered as one of the remotest areas of Zambia.

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5.2 Haulage distance

Once again all the interviewees agreed that hauling distance in transporting material and equipment had a high impact on cost. In fact five of the seven interviewees emphasised that as such fuel should be included as a separate factor.

5.3 Delayed payments

Interviewees bemoaned the continued occurrence of delayed payments in the road sector. It was agreed that stakeholders did factor potential delays in payment into their pricing of contracts. Apart from delays resulting in slowing down or suspension of ongoing works, three interviewees felt that this led to fraudulent activities in the sector.

5.4 Project planning and management

Inclusion of project planning and management as a high impact cost factor gave an insight into the operations of the road sector in Zambia. Interviewees felt that issues that led to the increase of cost due to this factor included: the practice of appointing supervision consultants after appointing the main contractor; procuring works without sufficient budget allocations; incomplete or uncoordinated bid documents calling for more addenda during tendering; proceeding with projects before they are well defined; improper use and calculation of contingencies; lack of engineer's estimates; and absence of appropriate economic models in the estimating process.

5.5 Foreign exchange rate

Only two out of the seven interviewees stated that the inflation rate should be used as opposed to the exchange rate. Though all payments on road contracts were made in Zambian Kwacha with a price adjustment clause to contracts longer than 18 months, the remaining interviewees stated that the exchange rate was appropriate because road contracts had high import content of input costs such as bitumen, equipment purchase and associated maintenance cost (spare parts), steel reinforcement and fuel. One interviewee went on to state that the percentage of fuel increase could be used as a unit cost index.

5.6 Other anticipated factors

It was interesting to note that political risk and corruption were not major factors as anticipated because in 2011, the Government of the Republic of Zambia placed the road sector under the auspices of the president's office reporting directly to the head of state. It was felt that this would increase the political risk profile of the construction industry.

The interviews further revealed that advance payment, the type of project consultant and competition had minimal influence on prevailing market rates contrary to the previous study conducted by RDA (2009) which indicated that:

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- when advance payments were removed from Government construction contracts in 2008, the impact on contractors' prices was significant as the cost of borrowing in Zambia was high. However, interviewees felt the position was different today;

- knowing the supervising consultants was important though the impact was not stated. The interviewees felt this had minimal effect; and

- lack of competition was a factor increasing rates on larger contracts, particularly since 2008 because when competition was reduced and a large number of contracts are tendered, as in 2008, contractors tended to increase their prices.

During the interviews additional factors were highlighted. Though energy costs were included as part of plant and equipment productivity, it was emphasised that energy costs such as fuel should be a stand-alone item. It was recommended that soil and climate factors be combined and renamed as topography – terrain. Other factors were contractor work conditions, inflation, funding source, design criteria such as number of lanes, pavement layer and base material. Four out of the seven interviewees argued that the project scope or design criteria could not be a factor as that was part of actual costs of construction. Under country specific factors one interviewee felt that a country's stability contributed to unit costs. Generally, all factors that were included under the contractor specific category scored high on the ranking implying that any changes on unit costs would have to target the contractor.

In summary, the Zambian road economic strata revealed that contractors have to deal with delayed payments in the sector, long haulage distances and questionable project planning and management by public sector clientele institutions. The selected factors in the first, second quartile and additional factors will be further investigated through a questionnaire survey.

6.0 Conclusions

Reviewed literature indicated that the influencing cost factors reveal an insight into the construction economic strata of a country. Overtime, it was likely that the influencing cost factors would change depending on the country's political, economic social and technological transformation. Therefore it would be prudent to investigate the said cost factors periodically.

Initial desk study revealed that there was a variation of more than 160% - 2000% in unit costs among bidders indicating an area of concern amongst stakeholders in the Zambian road sector. Preliminary interview results showed that factors that influence cost in the Zambian construction industry include location, haulage distance, delayed payments and quality of the sector's project management. From the country's perspective some of the unexpected results were the political risk, corruption, advance payment, prior knowledge of supervising consultants and competition which were expected to feature in the first quartile but were in the lower quartiles. In summary, the Zambian road economic strata revealed that contractors have to deal with delayed

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payments in the sector, long haulage distances and questionable project planning and management from public clientele institutions.

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4

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HEALTH AND SAFETY MANAGEMENT PRACTICES LEVEL OF COMPLIANCE ON CONSTRUCTION SITES IN ILORIN METROPOLIS, NIGERIA

Richard Jimoh[1], Augustine Ijigah[2], Mahrufdeen Nuah[3]

Abstract

In both developed and developing countries, the construction industry is considered to be one of the most significant industries in terms of its impact on health and safety of the working population, making it both economically and socially important. However, the construction industry is also recognized to be one of the most hazardous compared to other sectors of the economy. For this reason, this study aims at evaluating the health and safety practices on construction sites in Ilorin metropolis with a view to enhancing workers performances in order to improve firms' productivity. The data were collected from construction personnel and operatives using questionnaire survey to evaluate health and safety practices on the construction sites which were analysed using Mean Score (MS). In total, there were 70 questionnaires which were self-administered, with a response rate of 64.3%. In addition to this, the layouts of 8 active construction sites were observed, ranked and analysed using mean score. It was observed that the level of commitment from the clients, the regulatory agencies, the contractors, operatives/workers, and also the consultants (designers) towards the improvement of health and safety practices on the construction sites was still at an average level based on the mean scores obtained. Also, on the site layout, the only health and safety practice that has the least consideration is the accommodation consideration which has MS of 2.750. Hence, all the stakeholders should be alive to their responsibilities so that the overall project objectives can be achieved.

Keywords: Health and safety; Practices: Compliance; Stakeholders; Construction

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1.0 Introduction

All over the world, construction according to International Labour Organisation [ILO] (1999) remains one of the highest employers of labour, ranging between 9-12% and could be as high as 20% in some countries working population. This high percentage has attendant consequence in terms of accidents rates on construction sites due largely to poor health and safety practices among others. Getting accurate reports on accidents in most countries is a huge challenge as many of them go either undetected or not reported at all. Kheni, Gibb and Dainty (2006) stated that small and medium firms dominate in the developing countries and this domination has given rise to the high rate of accidents found on construction sites of these countries. In a related development, ILO (1999) alluded to the fact that the high proportion of small firms and of self-employed workers contributed to the high rate of accidents and this feature distinguishes construction from the manufacturing industry. Though substantial progress has been made over the years, the need to continually improve the health and safety practices on construction sites cannot be overemphasised as a result of the dangerous nature of the industry (Langdon, 2011).

Many countries have put in place policies and legislation to reduce accidents and diseases on construction sites though having varied degree of comprehensiveness, the extent of implementation, will and capacity of enforcement. In spite of these efforts, Al-Tuwaijri, Fedotov, Feitshans, Gifford, Gold, Machida, Nahmias, Niu & Sandi (2008) stated that the ILO reported that there seems not to be any significant change in work related fatal and non-fatal accidents and diseases globally. This is as a result of the globalization of the world's economies. The implication is that this trend will continue as long as there are countries such as Nigeria that will be on its path to industrialisation. Hence, health and safety issues will continue to be in the national discourse for a very long time to come. This will be so for a long time because health and safety issues in small and medium construction firms have received less attention in terms of research efforts, non-documentation of the implementation of health and safety programmes and initiatives to reduce work related fatalities, accidents and diseases (Al-Tuwaijri *et al.*, 2008; Agumba & Haupt, 2009 and Kheni, Gibb & Dainty,2010).

For success to be achieved, according to Ikpe (2009), efforts at improving health and safety must be predicated on research in order to serve as a basis for formulating and implementing health and safety initiatives. When this is done, a synergy between health and safety and other project parameters (cost, environment, productivity, quality and schedule) will be created that will give rise to better performance within the industry (Smallwood, 1996 cited in Smallwood, 2002). According to Adeogun and Okafor (2013), it is the multinational construction firms that adhere and recognise health and safety practices due largely to the inclusion of such in the parent companies policies in their home countries. Adeogun and Okafor (*op. cit.*) therefore concluded that health and safety practices among indigenous firms are still at developmental stages; hence, evaluating the health and safety management practices of construction firms in Ilorin Metropolis becomes imperative in order to determine the level of compliance of the roles of the stakeholders.

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2.0 Methodology

Combination of questionnaire survey and personal observations were used in obtaining information. Seventy self-administered structured questionnaires were administered to construction professionals using convenience sampling method because of the homogenous nature of the construction sites. Forty-five of this were retrieved and used for the analysis (64.28%). In addition to this, eight (8) construction sites were visited in order to observe the way the sites were laid out using a ranking checklist prepared for that purpose. The checklist were ranked using a 5-Point Likert Scale, where 1 is the least important and 5 is the most.

The Mean Score (MS) analysis was used to rank stakeholders level of compliance with health and safety management practices on construction sites. The mean score (MS) is given as follows after (Odeyinka *et al.* 2011).

$$MS = \frac{5n_5 + 4n_4 + 3n_3 + 2n_2 + 1n_1}{(n_5 + n_4 + n_3 + n_2 + n_1)}$$

Where n1 = number of respondents who answered "very low" "very poor"

n2 = number of respondents who answered "low" "poor"

n3= number of respondents who answered "average"

n4 = number of respondents who answered "high" "good"

n5 = number of respondents who answered "very high" "very good"

3.0 Results and discussion

Table 1 below indicates that 40% of the answerers have experience between 1- 5 years, 31.1% represent professionals with 6 - 10 years, 22.2% of the total respondents are professionals with 11 - 15years of experience, and finally 6.7% are professionals with 20 years' experience and above.

Table 1: Years of Experience of Respondents

Years of experience	Frequency	Percentage
1-5years	18	40.0
6-10years	14	31.1
11-15years	10	22.2
Above 20	3	6.7
Total	45	100.0

Source: Field survey, 2013

This indicates that eleven of the respondents were architects representing about 24.4% of the total respondents. Six were builders representing about 13.3%. Seventeen were civil engineer

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represent about 37.8%. Seven of the respondents were quantity surveyor representing about 15.6%. Four of the total respondents were from others representing about 8.9%.

Table 2: Categories of Respondents by profession

Profession	Frequency	Percentage
Architect	11	24.4
Builder	6	13.3
Civil Engineer	17	37.8
Quantity surveyor	7	15.6
Other	4	8.9
Total	45	100.0

Source: Field survey, 2013

In Table 3 below, the respondents rank nominating a competent person to coordinate all safety and health activities on their projects comes first, requiring those submitting tenders to provide for the cost of safety and health quantifies during construction operation second and lastly, prequalifying contractors by evaluating their safety performance history on safe work practices with a Mean item score of 3.156, 3.044 and 2.889 respectively. From the table above, this is an indication that the two most complied roles by the clients fall at medium level of compliance and the average mean score is 3.0297.

Table 3: Clients' level of compliance health and safety management practice

s/n	Health and safety practice	** Level of compliance					No	Rank sum	Mean item score	Rank	Level of compliance
		1	2	3	4	5					
1	Nominating a competent person to co-ordinate all safety and health activities on their projects.	1	12	16	11	5	45	142	3.156	1	Average
2	Requiring those submitting tenders to provide for the cost of safety and health measures during construction process.	1	11	20	11	2	45	137	3.044	2	Average
3	Prequalifying contractors by evaluating their safety performance history on safe work practices.	0	20	14	7	4	45	130	2.889	3	Low → Average
	Average mean item score						**45**	**136.3**	**3.0297**		

**1= Very low, 2= Low, 3= Average, 4= high, 5 = Very high
Source: Field survey, 2013

Table 4 below shows the level of compliance by the regulatory agencies in construction industry and their individual ranking respectively. Adequate laws and regulations or code is the first in

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the list with mean score of (3.378), followed by appropriate inspection services to enforce the law with a mean score of (3.022) and then adequate enforcement by all the safety inspectors responsible for enforcement with a mean score of (2.933). The least of all is the adequate resources to carry out the inspection for enforcement of the laws with a mean score of (2.867). The average mean score of regulatory agencies is 3.050

Table 4: Regulatory agencies level of compliance with health and safety management practice

s/n	Health and safety practice	**Level of compliance					No	Rank sum	Mean item score	Rank	Level of compliance
		1	2	3	4	5					
1	Adequate laws, regulations or codes.	2	5	18	14	6	45	152	3.378	1	Average
2	Appropriate inspection services to enforce the laws.	4	10	19	5	7	45	136	3.022	2	Average
3	Adequate enforcement by all the safety inspector agencies responsible for enforcement.	3	15	13	10	4	45	132	2.933	3	Low → Average
4	Adequate resources to carry out the inspection for enforcement of the laws.	3	16	14	8	4	45	225	2.867	4	Low → Average
	Average mean item score						**45**	**137.3**	**3.050**		

**1= Very low, 2= Low, 3= Average, 4= high, 5 = Very high
Source: Field survey, 2013

Table 5 shows that assigning workers only to jobs for which they are suited by their skill comes first with mean score of (3.756), this is followed by ensuring at regular intervals the safety of plant and equipment by competent persons with mean score of (3.622). Materials are used which are suited from a health and safety point of view was selected as the third most complied role with mean score of (3.578), closely followed by working methods are employed which protect employees from the harmful effects of physical, biological and chemical agents with mean score of (3.533) and provision of supervision as this will ascertain that workers execute their work with due respect to their health and safety with mean score of (3.511) as the five most complied roles of contractors with health and safety management practice. The table also reveals that Liaising with designers on factors affecting safety and health as the least complied role with mean score of (3.022). The average men score for contractors level of compliance is (3.183).

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Table 5: Contractors level of compliance with health and safety management practice

s/n	*Health and safety practice by construction contractors*	**Level of compliance					No	Rank sum	Mean item score	Rank	Level of compliance
		1	2	3	4	5					
1	Assigning workers only to jobs for which they are suited by their skill.	1	6	10	14	14	45	169	**3.756**	**1**	Average → high
2	Ensuring at regular intervals the safety of plant and equipment by competent persons.	0	2	21	14	8	45	163	**3.622**	**2**	Average → high
3	Materials are used which are suited from a safety and health point of view	0	4	20	12	9	45	161	**3.578**	**3**	Average → high 3
4	Working methods are employed which protect workers against the harmful effects of chemical, physical and biological agents.	0	8	15	12	10	45	159	**3.533**	**4**	Average → high 4
5	Provision of supervision as will ascertain that workers execute their work with due respect to their safety and health.	0	6	17	15	7	45	158	**3.511**	**5**	Average → high
6	Make suitable arrangement consistent with national laws and regulations in ensuring safe working conditions.	0	7	19	9	10	45	157	**3.489**	**6.5**	Average
7	Provision of personal protective equipment such as helmets, boots, clothing, etc.	0	8	18	8	11	45	157	**3.489**	**6.5**	Average
8	Ascribing employees only to jobs for which they are fitted by their state of health.	0	8	14	17	6	45	156	**3.467**	**8**	Average

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9	Taking all appropriate measures to protect persons working at a construction site from all risks which may occurs from such site.	1	10	14	10	10	45	153	**3.400**	**9**	Average
10	Dangers likely to occur at the place of work are prevented as soon as possible	1	10	14	12	8	45	151	**3.356**	**10.5**	Average
11	Provision of appropriate first aid.	2	12	8	14	9	45	151	**3.356**	**10.5**	Average
12	Acquisition of plant and equipment conforms to national laws, regulation and codes on health and safety on sites.	1	6	24	8	6	45	147	**3.267**	**12**	Average
13	Ascertaining that workers are made aware of the related laws, regulations or codes relating to deterrence of accidents and injuries to health.	1	11	18	6	9	45	146	**3.244**	**13**	Average
14	Assigning employees only to works for which they are befitted by their age.	2	8	16	16	3	45	145	**3.222**	**14**	Average
15	Excessively strenuous work positions are avoided	1	9	19	13	3	45	143	**3.178**	**15.5**	Average
16	Excessively strenuous work movements are avoided	2	10	17	10	6	45	143	**3.178**	**15.5**	Average
17	Prequalifying subcontractors by evaluating their safety performance history on safe work practices.	0	10	22	9	4	45	142	**3.156**	17	Average
18	Provision of training and orientation on health and safety issues to workers.	1	11	20	11	2	45	137	**3.044**	18	Average
19	Liaising with designers on factors affecting safety and health.	2	10	20	11	2	45	136	**3.022**	19	Average
	Average mean item score						45	143.2	**3.183**		

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** 1= Very low, 2= Low, 3= Average, 4= high, 5 = Very high
Source: Field survey, 2013

The Table 6 below shows the mean score of health and safety practices as carried out by the operatives on various construction sites in Ilorin metropolis. Removing themselves from danger to their safety or health is ranked first, with a mean score of 3.822. Taking due care for the health and safety by their acts or omissions at work is ranked second, with a mean score of 3.578. Using (Personal Protective Equipment) PPE such as helmets, boots, clothing, etc. is ranked the third, with a mean score of 3.511 and lastly, expressing their views on working methods used as they may influence health and safety with mean score of 3.444 as the fourth ranked complied with by the operatives on site. Also, obtaining information from the contractor regarding health and safety risk associated with work processes ranked as the least of all with mean score of 3.222. The average mean score for operatives/workers health and safety management practice is 3.464.

Table 6: Operatives/workers level of compliance with health and safety management practice

s/n	Health and safety management practice	**Level of compliance					No	Rank sum	Mean item score	Rank	Level of compliance
		1	2	3	4	5					
1	Removing themselves from danger to their safety or health.	0	3	16	12	14	45	172	**3.822**	1	Average → high
2	Taking reasonable care for the health and safety by their acts or omissions at work.	0	6	17	12	10	45	161	**3.578**	2	Average → high
3	Using Personal Protective equipment (PPE) such as helmets, boots, clothing, etc.	0	7	18	10	10	45	158	**3.511**	3	Average → high
4	Expressing their views on working methods used as they may affect health and safety.	0	4	22	14	5	45	155	**3.444**	4	Average
5	Obtaining information from the contractor as regards regard health and safety procedures related to work processes.	0	6	17	20	2	45	153	**3.400**	5	Average

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6	Participation in regular safety and health meetings.	0	12	12	13	8	45	152	**3.378**	6	Average
7	Complying with the given health and safety measures.	1	8	16	14	6	45	151	**3.356**	7	Average
8	Obtaining information from the contractor as regards health and safety risk associated to work processes.	1	12	14	12	6	45	145	**3.222**	8	Average
	Average mean item score						45	155.9	**3.464**		

** 1= Very low, 2= Low, 3= Average, 4= high, 5 = Very high
Source: Field survey, 2013

As for the designers from Table 7, taking into account the safety problems related with subsequent maintenance is ranked first with mean score of 3.622. The next one by the designers is integrated safety and health of workers into their designs with relative importance index of 3.356, followed by receiving training in safety and health with mean score of 3.333 and the least of all the roles is including anything in the design that would require the use of dangerous procedures which could have been prevented with mean score of 3.133. The average mean score of level of designers' compliance is 3.361.

Table 7: Designers level of compliance with health and safety management practice

s/n	Health and safety practice	** Level of compliance					No	Rank sum	Mean item score	Rank	Level of compliance
		1	**2**	**3**	**4**	**5**					
1	Taking into account the safety problems related with subsequent maintenance.	0	2	19	18	6	45	163	**3.622**	1	Average → high
2	Integrated safety and health of workers into their designs.	0	5	23	13	4	45	151	**3.356**	2	Average
3	Receiving training in safety and health.	0	10	17	11	7	45	150	**3.333**	3	Average
4	Including anything in the design that would require the use of dangerous procedures which could have been prevented.	2	8	20	12	3	45	141	**3.133**	4	Average
	Average mean item score						45	151.3	**3.361**		

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** 1= Very low, 2= Low, 3= Average, 4= high, 5 = Very high
Source: Field survey, 2013

Eight construction sites were visited as indicated in Table 8. The stakeholders interviewed were contractors, quantity surveyors and health and safety consultants. The interviewees were asked questions pertaining to the implementation of health and safety management practice on the construction sites. Site 8 has the highest health and safety management compliance with mean score of 4.289, while site 1 has the least mean score of 2.857.

Table 8: **Summary of site visitation**

Question asked	**Site 1**	**Site 2**	**Site 3**	**Site 4**	**Site 5**	**Site 6**	**Site 7**	**Site 8**
Access consideration	Good	Good	Good	Good	Good	Good	Very good	Very good
Storage consideration	Average	Average	Good	Good	Good	Good	Good	Good
Fencing and hoarding consideration	Poor	Average	Good	Good	Good	Good	Good	Very good
Plant consideration	Average	Average	Average	Average	Good	Good	Good	Good
Temporary service consideration	Average	Average	Average	Average	Average	Average	Good	Good
Safety and health consideration	Average	Average	Average	Average	Average	Average	Average	Good
Accommodation consideration	Poor	Poor	Poor	Average	Average	Average	Average	Good
Site summary	**20**	**21**	**23**	**24**	**25**	**25**	**27**	**30**
Site mean score	**2.857**	**3.000**	**3.286**	**3.429**	**3.571**	**3.571**	**3.857**	**4.289**

Table 9 below indicates access consideration was the most complied with having mean score of **4.250**. The next importance level of compliance is both storage consideration and fencing and hoarding consideration with mean score of 3.750 respectively, this is followed by plant consideration with mean score of 3.500. The next less level of compliance is temporary service consideration with mean score of 3.250. The least of all is accommodation consideration with a mean score of 2.750 and the average mean score of site layout level of compliance is 3.482.

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Table 9: Site layout level of compliance with health and safety management practice

s/n	Health and safety practice	**Level of compliance					No	Rank sum	RII	Rank	Level of compliance
		1	2	3	4	5					
1	Access consideration	0	0	0	6	2	8	34	**4.250**	1	High
2	Storage consideration	0	0	2	6	0	8	30	**3.750**	2.5	Average → high
3	Fencing and hoarding consideration	0	1	1	5	1	8	30	**3.750**	2.5	Average → high
4	Plant consideration	0	0	4	4	0	8	28	**3.500**	4	Average → high
5	Temporary service consideration	0	0	6	2	0	8	26	**3.250**	5	Average
6	Safety and health consideration	0	0	7	1	0	8	25	**3.125**	6	Average
7	Accommodation consideration	0	3	4	1	0	8	22	**2.750**	7	Low → Average
	Average mean item score						8	27.86	**3.482**		

** 1= Very low, 2= Low, 3= Average, 4= high, 5 = Very high
Source: Field survey, 2013

4.0 Discussion

To improve H&S performance in Nigeria construction sites, a number of programmes can be developed and adapted from existing initiatives undertaken in other countries as it can be seen from the study that the overall level of compliance fall short of expectation. Also implementing it in a way which is sensitive to the contextual variables of construction sector in developing countries is important. Research on other developing countries has placed several deficiencies in H&S performance. These include research by (Jill & John, 2010). And also academia and industry research initiatives by (Gibb and Bust 2006, Farooqui *et al.* 2008, Alkilani *et al.* 2012, Alkilani, et al. 2013) also discuss Issues of construction health and safety in developing countries. These researches propose solutions and recommendations on a range of H&S challenges facing the construction industries of developed and developing countries and have mainly focused on programmes and policies that are either led by government *or* industry.

5.0 Conclusion

The study evaluated the level of compliance of health and safety practices on construction sites in Ilorin Metropolis. On the whole, the compliance level of the operatives/workers, the designers and the contractors could be deemed to be at medium level. However, in terms of the site layout consideration, accommodation was the least ranked and this is not surprising as many small and medium construction sites do not give much consideration to this aspect as operatives are

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usually seen during lunch break looking for any available space that will hide them from the sun in order to be able to eat their lunch. Mostly, clients want the job done on time without given any consideration to the past safety records of the contractors hired to carry out the jobs, hence, the least average mean score value of 3.0297 was recorded of client compliance with health and safety management practice on construction sites.. Enforcement by the regulatory agencies has been weak due in part to the limited number of inspectors that are available and the level of commitment shown by the various levels of government especially the Federal Government. Stemming from the above, all the stakeholders must be alive to their responsibilities so that the overall project objectives can be achieved.

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ERGONOMICS AND CONSTRUCTION STUDY: PERCEPTION OF THE GENERAL CONTRACTORS IN THE SOUTH WEST OF NIGERIA

Ajayi, O.[1], Thwala WD[2]

Abstract

The construction industry is a dangerous place to work as its physical processes entails various ergonomic-related problems. The study investigates the frequency at which ergonomics problems are encountered, the safety consideration of construction workers in construction project delivery, the extent of construction management on construction ergonomics, and their contribution to the occurrence of WMDs. The methodology adopted for the study is the use of historic data in exploring the non-adherence to occupational health and safety standard at worksites in construction as well as quantitative survey method based on questionnaire to achieve its objective which investigates the perceptions of general contractors (GC) in the South West of Nigeria regarding the consideration of safety among construction workers. The findings provide documentary evidence for the need for and the value of improving knowledge and awareness relative to construction ergonomics among the Nigeria general contractors (GC). Furthermore the findings provide an insight to the perception of the Nigeria General Contractors (GC) on construction ergonomics and the employment of a safety measures which is considered a burden. The study afforded the researchers to amplify the need for designers to deliberate the implications of and the processes resulting from design, details, method of fixing, specifications, or a combination thereof. The study revealed the need for the raising of awareness relative to construction ergonomics among the GCs in the south west of Nigeria. Furthermore, the paper makes a contribution to industry development in that it highlights the role of various design, and construction interventions relative to construction ergonomics.

Key words: Construction, Design, Ergonomics, Health and safety (H&S)

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2.0 Introduction

Construction is physically a demanding occupation. The construction industry is consistently ranked among the most dangerous occupations and accounts for a disproportionately large percentage of all work-related illnesses, injuries and deaths (Samuels, 2005). Construction workers are more at risk of an accident, ill health and/or even a fatality at work than other manufacturing-based industries (Ajayi and Thwala 2011a). The construction industry is been described as an industry characterized by fragmentation, multiplicity of operations, multiplicity of crews and industry culture. Each of these however contributes to unforeseen and unfamiliar hazards or the unsafe behaviour of workers' generally, construction sites are still one of the most dangerous workplaces, because of the high incidence of accidents. However, the construction industry is a hazardous environment where workers have direct exposure to heights, forces, and power. Workers face these risks every day of their working lives. Construction work typically requires the adopting of awkward postures, lifting of heavy materials, manual handling of heavy and irregular-sized loads, frequent bending, bending and twisting of the body, working above shoulder height, working below knee level, and pushing and pulling of loads. These are all done under difficult circumstances (Smallwood, 2004). The physically demanding nature of this work helps to explain why injuries are so prevalent. These factors contribute to the risk of musculoskeletal Injuries and are called risk factors. Here a risk factor is something that increases the risk of worker incurring work related musculoskeletal injuries.

According to Ajayi and Thwala (2012), numerous construction tasks pose significant ergonomic risks to workers, thereby exposing the workers to WMDs. Some of the most common injuries in construction are the result of job demands that push the human body beyond its natural limits. Workers, who must often lift stoop, kneel, twist, grip, stretch, reach overhead or work in other awkward positions to do a job at risk of developing a work-related musculoskeletal disorder (WMDs). These disorders cover a wide range of phenomena and experiences, which entail injuries to joints, muscles, ligaments, tendons, peripheral vessels, or nerves.

Statistics provided by the US Labour Statistics indicate that the rate of sprains and strains in construction, namely 1.8 per 100 full-time construction workers, predominate in terms of the nature of injuries and illness resulting in days away from work, and is the second highest of all industries (Smallwood et al., 2000).

According to the Bureau of Labour Statistic economic news release (BLS) (2012), out of 388,060 non- fatal injuries reported, sprain and strain (33.6%), back (28.3%), upper Extremities (33.5), Lower Extremities (24.4%), overexertion (18.4%) and 28.0% of workers were absent from work 31 days or more. Rwamamara (2007) reported that musculoskeletal Injuries formed 73% of all reported work-related disease in the construction industry in Sweden.

In the United States, about 1.8 million workers experience WMDs symptoms every year. The construction industry accounts for about 12% of all occupational injuries and illness although it employs less than 6% of the labour force and the fatality rate is 15.2 per 100 000 workers

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compared to 4.2 in manufacturing, and with an injury rate of 7.9per 100 000 workers (Vedder and Carey, 2005; Laura and Wegman., 2008). In the Swedish construction industry, more than one man in five, twice as many as for all men employed, reported work related injuries and these disorders constitute about 69% of all reported work-related injuries in 2005 (Simons son and Rwamamara, 2007: 302-303).It has been ascertained that occupational health hazards are common to all industries and can be particularly acute in the construction industry. Rowlinson (2003) argues that we rarely see discussions in the press and programmes on the television relating to occupational health, but occupational accidents are commonly reported and their seriousness is obvious, but the losses due to occupational health problems are at least as great as those stemming from occupational accidents.Based on the findings of ergonomics-related research conducted among South African construction management and workers, Smallwood et al. (2000) conclude that the use of body force, reaching away from the body, reaching above the head , repetitive movements, bending or twisting the back, climbing and descending, were common, and constitute work-related job problems

However, the ILO (2001) has indicated that, workers in the construction industry experiences high rate of occupational health and safety issues especially in the developing countries. This led some writers to research in that area and that indeed in almost all cases, there were pieces of evidence indicating that the health and safety of casual workers had been compromised.

The challenge facing the construction industry in many developing countries is the lack of comprehensive legislative framework and statutory instruments as far as safety of workers are concerned unlike the developed countries where acts and regulations has been set to safeguard the health and safety of workers (Vitasini et al., 2007). The influence of MSDs as a challenge on organizational productivity and loss of control in the Nigerian construction industry as peculiar to other developing countries has not been taken seriously by the stakeholders. It is assumed that the impact has a direct relationship with employees (construction workers) in view of the fact that the assigned tasks can only be safely accomplished when workers are in a good state of health and the work environment is safe and conducive for the execution of assigned duties.

Nigeria being a developing country is also susceptible to the challenges that the construction industries pose to other developing countries. The lack of enough information on good construction industry practices on the management of WMDs on the workers in Nigeria construction industry is skewed.

2.0 Overview of health and safety (H&S) issues in Nigeria construction industry.

Construction H&S is impacted on by various participants across the life cycle of a construction project. The H&S of the human being at work or on a construction site is a complex problem. Decisions made at one stage in the life cycle also affect H&S at another stage further down in the life cycle, and key responsibilities at the various stages are to appoint participants that have the necessary competence and capacity in construction H&S relevant to the project risks (Figure 1.0 shows the life cycle of construction project). Furthermore, construction H&S performance is influenced by the H&S specification, communication of H&S expectations,

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requirements from one participant to the others, and importantly on the effective monitoring of compliance with these expectations. Idoro (2011) opines that in most developing countries, safety consideration of construction workers in construction project delivery is not given a priority and the employment of safety measures during construction is considered a burden as it is not addressed. However, in the Nigeria construction industry, the risks are transferred to the contractors by the client while the contractor extensively translate all operational risks to the operatives and disposition to knowledge transfer in terms of health and safety of the workers are being considered not so important.

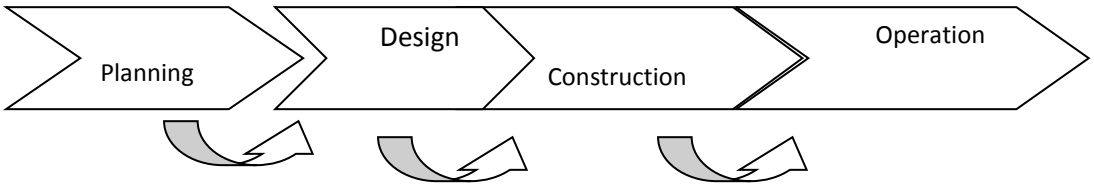

Figure 1: showing lifecycle stages of construction project.
Source: Ajayi and Thwala (2011a)

Olatunji et al.,(2007) stresses that construction client reserves the mandate to be put at the core of construction process with a desire of desiring maximum value for their project at the cheapest cost.

Therefore the disposition of construction clients to the flow of resources has a lot to do with the quality and value of safety in any construction product development process (Ajayi and Thwala 2011b). Achieving optimal safety in any construction project is a function of the vulnerability of constituent materials critical safety factor. To date the Nigerian construction industry has got no coherent package of standard document to guide her material specification and standards. British and Australian standards are always preferred (Olatunji et al., 2007). Regrettably, construction workers in Nigeria are always exposed to unfavourable ergonomic factors and severe environmental hazards which results in acute injury, chronic illness, permanent disability or even deaths through immediate effects of direct exposures

In a research conducted by Yakubu and Iyagba (2010) on OH &S culture in the Nigerian construction industry, it is reiterated that Nigeria as a country has been severely afflicted with many preventable occupational hazards which is premised on the issue that the OH&S have been seriously undermined. Furthermore, it is also concluded that in the Nigerian construction industry, there is poor H &S performance.

In view of the Nigerian Government's non participation in the construction industry, construction companies are severally faced with the problem of non-performance of H&S culture vis-a-vis non-adherence to occupational health and safety standard at worksites/ It is also characterized by insufficient planning, intangible safety-in-design processes to reduce risks on construction worksites, non-involvement of employees in the occupational health and safety culture policy

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drafting, labour motivation arising from employers 'enactment of occupational health and safety culture. The facts of such a culture include a good healthcare scheme and clearly defined construction H&S practices, though the construction regulations are perceived to have had a wide spread impact and in particular increased the H&S performance in the industry. Idoro (2011), Ajayi and Thwala (2012)confirmed that the impact cannot be quantified as it can be inferred that the construction regulations have not had a positive impact in reducing H&S injuries and accidents in Nigeria. In a pilot study on an overview of possible constraint to H&S performance, Yakubu and Iyagba (2010) submitted that:

- Nigeria does not have a written H&S policy in place and this has reflected in our practices and attitudes at construction worksite
- Workers seldom undergo H&S induction before they are allowed to start work; poor attitude to proper care and use of PPE; greatly required H&S education and training
- Workers are not allowed to participate in H&S policy drafting
- Nigerian construction workers lack proper H&S supervision
- There are no separate construction regulatory and supervisory body to monitor H&S training vis-à-vis H&S performance and report unsafe H&S attitude, treatment and unfair compensation of construction workers.
- There are no records of accident, fatalities injuries and hazards for the construction industry

However, apart from the fact that Nigerian construction workers seldom receive modern technological training imperative to modern dynamic requirements of their job, they are mostly seen as indigent workers who rarely respect their skills in terms of remuneration. The workers' psyche is affected by low remuneration, poor working conditions and social perceptions (Ajayi and Thwala 2011b; Olatunji et al., 2007).

Adenuga et al., (2007) and Idoro (2011), posits that occupational health and safety (OH&S) is to assist all stakeholders to strive at improving their management effort on health and safety at workplace. The Health and Safety Executive (HSE) 30 in the UK contends that clients have a pivotal role in setting and achieving high standards in H&S as they:

• set the tone for projects;

• have overall control of contracts and how projects are undertaken;

• make key decisions such as those related to budget and time; and

• select the designers and contractors.

Furthermore, experience indicates that high H&S standards are achieved on projects where clients are committed to H&S and provide appropriate management oversight. Olatunji et al.,

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(2007), Yi and Langford (2006) argues that construction client reserves the absolute mandate to be put at the core of the construction process. Thus construction clients desire the maximum value for their project at the cheapest possible cost within the shortest possible time. Therefore the disposition of construction clients to the flow of the resources has a lot to do with the quality and value of safety in any construction product development process.

However, the HSE31 notes that the challenge is to educate and motivate clients regarding the importance of their role and the benefits of well-managed, healthy and safe projects which will require clear evidence of the costs and benefits.

In a pilot study by Ajayi and Thwala (2011a) conducted to investigate the impact of construction activities on construction workers in the Nigerian construction industry as it precipitates into WMDs thereby affecting the rate of productivity by, the author contends that:

- Unfavourable ergonomics practices exist in Nigeria construction sites
- Construction activities negatively impacts on construction workers
- Work organisation influences process and activities
- The awareness relative to ergonomics to reduce the impact of WMDs among construction workers is needed
- Designers need to consider in their designs on how to eliminate/ reduce construction injuries such as WMDs
- Effective strategies are needed to promote construction workplace health and safety.

A holistic approach to H&S requires the integrated development of work organisation and physical environment, work organisation and physical environment requires an appreciation and understanding of the role of planning and pre-planning of H&S to realise optimum ergonomics.

3.0 Ergonomic problems and trades

The workplace addresses the construction worker assignment from the perspective that the worker has the capability of performing the assigned tasks within a specified time. Ergonomics studies work or the work system includes the workers, their tools and the workplace thereby optimizing a basic principle of creating an appropriate balance between requirements of the work and the capacity of the working person. The challenge is in the manner in which construction activities are executed which adversely affects the health of construction workers. In a review of epidemiological evidence for WMDs, Rwamamara (2007) conclude that there is evidence of an association between MSDs and certain work related factors in which there is an exposure to the physical factors, injury is the outcome.

Samuels (2005) and Buchholz *et al.* (2003) report that arranging the environment to fit the worker rather than the worker fitting the environment reduces fatigue and Work related Musculoskeletal disorders (WMDs). In the working environment, a well-designed workspace with appropriate materials and tools is beneficial to construction workers.

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4.0 Methodology

In getting data for the research, the research approach adopted was a questionnaire survey targeting purposively selected contractors in the south- west of Nigeria as sought from databases of Federation of Construction Industry (FOCI) and federation of building and civil engineering contractors (FOBACEC) respectively. This population of registered contractors constitute formal registered contractors in the Nigeria construction industry and formed part of the stakeholders in the industry. The questions were premised on: (A) Stakeholder's information (B) Perception of construction activities and occurrence of WMDs in construction (C) Perception of trades and ergonomic problems, (D) Perceptions of construction site actions and its impact on the body and (E) their perceptions of the design and ergonomic intervention.

The variables in the research are quantitative in nature and discrete as the respondents were required to respond to the questionnaire so as to indicate their perception for scaling on a five point Likert scale The respondents were asked to indicate their perceptions relative to the questions on a five point Likert scale 1(minor) to 5 (major) and a Mean Scores (MS) ranging between 1.00 and 5.00.

The scale ranges from minor extent(1), near minor extent(2), some extent(3), near major extent(4) and Major extent (5), Given that there are five points on the scale and that the difference between 5.00 and 1.00 is 4, and 4 / 5=0.8, then ranges with a width of 0.8 can be identified which in turn enables a more review of the mean scores (MSs).The rationale being that an initial review in terms of whether MS ≤ 3.00 or > 3.00 indicates that the variable in question occurs to more of a minor or greater extent. The data were captured using Epi-info statistical package version 3.5.1 and exported to IBM Statistics SPSS version 19 for univariate statistical analysis to measure the relationship between the variables and the frequency distribution. The 65 questionnaires received out of 100 questionnaires sent out enabled the achievement of the research objectives. As discussed below, only 63 responses were analysed. Two of the respondents that indicated both subcontractor and contractor at the same time were not included in the analysis and therefore discarded. The survey resulted in a net response of 58%.

5.0 Findings and Discussions

Table 1 presents a summary of percentage response of stakeholders category obtained from the survey data. Based on the responses, the respondents were asked to indicate their field of operations in the Nigerian construction industry, whether as a contractor or sub-contractor. 66.7% indicated that they are contactors while 33.3% indicated sub-contracting as their mode of operation.

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Table 1: stakeholders' mode of operations

Stakeholder group	% Response
Contractor	66.7
Sub-contractor	33.3
Total	100.0

The respondents were asked to indicate the years of practical experience as a contractor / subcontractor in the industry, as shown in the table2 below. It is notable that none of the respondents is below 5 years in their construction experience. Furthermore, 6% of the respondents are between 6 – 10 years of experience, and only 49% has been in practice for more than twenty years. These values indicate that the respondents have a good knowledge of construction site operations and its activities. They as well are familiar with construction workers' management.

Table 2: Years of experience of practice as contractors/ subcontractors

Category (Yrs. of practice)	Ratings	% Response
0-5	0	0
6-10	04	06
11-15	13	21
16-20	15	24
>20	31	49
Total	63	100

Table 3 indicates the perceived extent to which various risks in construction is associated with construction workers health and safety relative to fourteen design and construction related aspect in terms of percentage responses to a Likert scale of 1(minor) to 5(major) and MSs ranging between 1.00 and 5.00. It is notable that all the fourteen MSs are above the value 3.00. These indicate that the risks reference to H&S of construction workers relative to these designs and construction related aspects can be deemed to be prevalent. It is interesting to note that no parameters have their MS< 3.40. Furthermore, it should also be noted that all these parameters fall within the range of >3.40 ≤4.20, indicating that these parameters are not only prevalent to some extent but also impair on the health and safety of the construction workers. Based on the respondents' perception as presented in the table below, the top six ranked parameters are safe work procedure, design of working platform, health and safety knowledge in the design phase, training and awareness for workers, construction experience, layout planning, material planning and system to identify and solve problems during construction operations which literature indicates to all have an effect on construction workers health and safety.

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Table 3: Extent of various parameters on the risks associated with construction workers health and safety.

Parameters	Response (%) Minor……..Major						MS	Rank
	Unsure	1	2	3	4	5		
Safe work procedure	0.0	18.4	5.1	20.4	40.2	15.9	4.2	**1**
Design of working platform	0.0	1.7	5.9	20.1	23.5	36.8	4.10	**2**
HS knowledge in design phase	0.0	3.9	3.5	23.5	40.5	30.1	4.1	**3**
Training and awareness of workers	0.0	0.0	3.9	23.1	20.1	41.8	4.0	**4**
Construction experience	0.0	18.4	2.3	9.1	40.1	30.1	4.0	**5**
Layout planning	0.0	0.0	3.7	40.2	22.5	19.6	3.99	**6**
Material planning	0.0	4.5	22.9	11.4	25.0	36.2	3.99	**7**
System to identify and solve problems	0.0	4.7	4.1	9.6	52.2	23.5	3.99	**8**
Housekeeping	0.0	2.3	23.4	15.3	25.5	33.5	3.97	**9**
Design of tools	0.0	24.7	7.1	20.0	24.7	23.5	3.96	**10**
Design of workplace	1.2	4.7	9.3	19.8	27.9	37.2	3.85	**11**
Off-site prefabrication	1.2	5.8	14.0	14.0	25.6	39.5	3.80	**12**
Means of ascending and descending	1.2	8.1	11.6	15.1	27.9	36.0	3.73	**13**
Specification of material	0.0	5.7	13.6	19.5	40.2	21.8	3.62	**14**

Given the responses of the contractors on the availability of the ergonomic programme to their employees, it was noted that 91.7 % of the respondents does not have an ergonomic programme in place, 4.2% established that their employees do stretch training before construction work, 81.3% ascertained that there is no lifting programme in place for their workers. 77.1% does not have weight restriction while 41.7 % of the respondents have a work practices and protective equipment for vibrations. These indicate that there is a poor knowledge of the advantage of ergonomic intervention programme to contractors.

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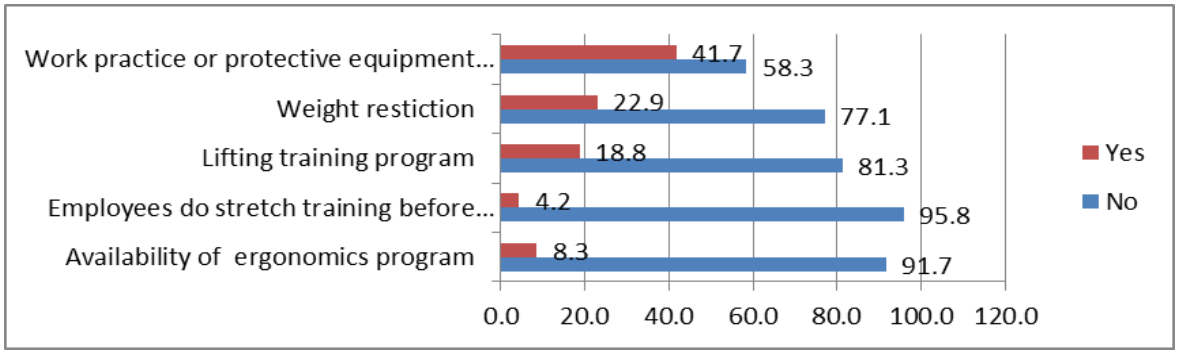

Figure 2: Ergonomics program in construction workplace

The respondents were required to self-rate in terms of their perception on the knowledge of extent to which design and construction related intervention and issues could optimize construction ergonomics on a scale 1(minor) to 5 (major) and a MS ranging from 1.00 to 5.00. However, relative to fourteen design construction and procurement issues in the table 4 below, it is notable that all the MSs are 3.00 and above which indicates that the respondents perceived the design and construction related various aspect of interventions have potential to contribute to an improvement during the various phases of the project. Re -engineering of construction procurements predominates with MS=4.80 falling within the range between >4.20 ≤ 5.00- between near major to major / major extent. This indicates that, based on the respondents' perception, this intervention has a high potential to a major extent to contribute to optimization of construction ergonomics.

Table 4: Extent to which design and construction interventions/issues optimise construction ergonomics

Extent to which design and construction interventions/issues optimize construction ergonomics	**Response (%) Minor……Major**						**MS**	**Rank**
	Unsure	**1**	**2**	**3**	**4**	**5**		
Reengineering of construction procurement	7.8	1.6	6.3	29.7	23.4	31.3	4.80	**1**
Layout planning	0.0	0.0	0.0	27.3	34.3	54.5	4.32	**2**
General design	0.0	0.0	0.0	9.1	40.5	50.4	4.24	**3**
Design of workplace	0.0	0.0	0.0	9.1	18.2	63.6	4.22	**4**
H&S Knowledge in the design phase	0.0	9.1	0.0	20.2	25.3	15.4	4.08	**5**

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Prefabrication Preassembly	0.0	0.0	18.2	27.3	9.1	45.4	4.08	**6**
Training and awareness of workers	0.0	9.1	0.0	18.2	27.3	15.4	4.08	**7**
Material handling	0.0	0.0	10.3	21.8	32.2	35.6	3.93	**8**
Construction experience	0.0	20.3	7.3	25.1	20.0	27.3	3.92	**9**
Workplace organization	0.0	0.0	9.1	18.2	36.4	36.4	3.89	**10**
Safe work procedure	0.0	0.0	18.2	9.1	36.4	36.4	3.83	**11**
Design of tools	0.0	0.0	0.0	9.1	0.0	72.7	3.73	**12**
Mechanization	0.0	0.0	3.4	38.6	29.5	28.4	3.63	**13**
Contractor planning	0.0	0.0	9.1	27.3	36.4	18.2	3.33	**14**
Specification of material	0.0	0.0	12.5	28.4	27.3	31.8	3.00	**15**

It is notable that 61% of the highlighted issues have the MSs fall within the range >3.40 ≤ 4.20 indicating that the intervention exhibit the potential to some extent. 30% fall within the range >4.20 ≤ 5.00- between near major to major / major extent while 15% fall < 3.40, indicating that the intervention within this group exhibit their potentiality on a minor extent. Furthermore, it is notable that the three top ranked aspects that are of great potential are re-engineering of construction procurement, layout planning, general design, design of workplace, prefabrication, preassembly and training and awareness of workers in terms of prevalence of WMDs in the operation construction tasks. In general, the respondents appreciate the extent to which those various design related aspects impact on construction ergonomics and the potential at which various design, construction and procurement practices could contribute to improving construction ergonomics. The respondents perceived that training and awareness of workers to health and safety with knowledge in WMDs need to be address as it has potential in optimizing construction ergonomics.

6.0 Conclusions

The study, however, established that various interventions impact on the risks associated with health and safety of the construction workers and construction ergonomics**.** Based on the findings from empirical survey and the survey of literature, awareness relative to ergonomics is needed in the Nigeria construction industry and there is a need for designers to consider in their designs how to reduce or eliminate construction work injuries such as WMDs.

The study determined that baseline knowledge regarding the WMDs is inadequate as there are major concern about safety procedures and feedback from site employees .The result of the analysis

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relative to the mean scores indicate that there is need for an increase in training knowledge on strategies to reduce the onset of WMDs among construction workers. Baseline knowledge in the area of health and safety of construction workers is significant to construction site operations of construction workers.

To this end, health and safety plan or programme for construction workers hardly happens. Regrettably, there is no evidence of medical surveillance mechanism to show how the health status of workers was monitored. There is a need to detect early signs of illness in construction workers so that intervention may be taken to prevent permanent health damage resulting from occupational illnesses due to construction tasks.

7.0 Recommendations

Based on the findings of both empirical and the survey of literature, the level of awareness relative to ergonomics in construction needed to be raised. Also there is a need for the designers to mitigate or eliminate the probability of WMDs arising as a result of extraneous activities dictated by the design. The study established that participatory ergonomic approach is needed to provide good comfort and higher productivity for construction workers in Nigeria construction industry. Furthermore a multidisciplinary approach is needed in assessing and monitoring the risk of work related disorder in construction industry operations. The construction industry should ensure that every construction contract takes a comprehensive account of H&S requirements for projects, environment and the workers. Moreover, safety should be integrated into the physics of contractor's selection and procurement law as it is a subject to which most people are willing to pay lip service but which too few are willing to do something about. The construction companies should be encouraged to have safety advisers to train and re-train their workers in the identification and handling of H&S problems.

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A REVIEW OF FACTORS INFLUENCING CONSTRUCTION WORKERS' NUTRITIONAL UPTAKE

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Abstract

Nutrition is linked with construction worker health and safety (H&S) performance. Some accidents, injuries and in some cases, deaths on construction sites are direct or indirect results of physical and psychological distresses (chronic health conditions and mental instability) arising from poor nutrition of construction workers. This alarming situation could gravely affect construction workers, their families, the industry and the economy as a whole since health will be adversely affected, performance will be hindered, avoidable on-site exigencies, injuries and sometimes deaths will occur, resulting in lost working hours or days, lost wages, increased healthcare costs, and decline in productivity and Gross Domestic Product. This study therefore reviews the factors which influence the nutritional uptake amongst construction workers and possible interventions. This study is based on review of previous literature on the construction industry and its H&S performance, as well as factors influencing nutritional uptake and nutrition interventions in the construction industry. The literature review was based on both international and South African context. The study revealed that construction workers' nutrition is influenced by personal factors and environmental factors. The study also established feasible nutrition interventions based on these factors. Nutrition promotion initiatives need to target the different influences on construction workers' nutritional uptake. The study highlights construction workers' nutrition influencers and reveals feasible strategies to improve nutrition and thus safety performance on construction sites. Findings from this study will inform development and implementation of programmes and policies targeted towards nutritional uptake tailored for construction workers.

Keywords: construction workers, H&S performance, factors influencing nutritional uptake, nutrition interventions.

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1.0 Introduction

Nutrition is an occupational H&S concern and has been for decades (Wanjek, 2005). It plays an invaluable role in H&S performance and productivity improvements (Wanjek, ibid. Queensland Government, 2013). Proper nutrition based on consumption of healthy foods from different classes of food nutrients aids construction workers in maintaining healthy bodies and minds, maximum energy levels and alertness to safely undertake their physically and mentally demanding tasks thereby reducing the risks and rates of accidents and injury to them and those around them.

Research indicates that construction workers have poor nutrition (Deacon, 2004; Wanjek, 2005; Men's Health Forum (MHF), 2009; English & Bowen, 2011; Du Plessis, 2011 & 2012; Tiwary et al., 2012) and that they are at a significantly greater risk of developing chronic diseases such as diabetes, cardiovascular disease, and certain cancers, than workers in other industries (Queensland Government, 2012b). Improving nutrition requires an understanding and targeting of the factors influencing nutritional uptake (European Food Information Council (EUFIC), 2005). There has been research on factors that influence workers' nutritional uptake as well as on interventions. For instance, Wanjek (2005), which had a broader focus, incorporating workers in general, and more recently, Du Plessis (2011 and 2012), focused on construction industry apprentices. Successful nutrition interventions were evinced in Steyn et al. (2009), Du Plessis (2011) and Schroer et al. (2014), but included multi-faceted interventions incorporating other lifestyle components like physical activity.

However, although there has been some research on construction workers' nutrition and nutrition improvements, it appears that very little attention has been paid to the development of interventions targeted at the nutrition of construction workers in particular, taking into consideration the factors which influence their nutritional uptake. This is in spite of what, for example, Schroer et al. (2014) indicated in their study that focusing on lifestyle behaviour such as nutrition in workplace health promotions maximizes effectiveness.

The present paper reviews and incorporates evidence related to construction workers' nutrition and nutrition improvements, and advocates a set of interventions focused on improving nutrition based on the factors which influence construction workers' nutritional uptake. The study will be of help in developing a nutrition-focused intervention model for H&S tailored for construction workers in particular and will result in nutrition being given more attention in H&S performance considerations on construction sites. The objectives of this study are therefore to identify the factors which influence construction workers' nutritional uptake and establish possible interventions based on the factors identified.

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1.1 Overview of the importance of the construction industry

Murie (2007), Giang & Pheng (2011), Osei (2013) and Women in Informal Employment Globalizing and Organizing (WIEGO, 2014) noted that construction contributes immensely to global and national economies, accounting for about 10% of the global Gross Domestic Product (GDP), 7 – 10% of the GDP in developed economies and 3 – 6% in underdeveloped economies. The sector contributes about 4% to the GDP of South Africa (Statistics South Africa, 2014).

The construction industry generates income, alleviates poverty and improves living standards being the second largest employer worldwide (after agriculture) (WIEGO, 2014). It accounts for 7% of global employment (Ambekar Institute for Labour Studies (AILS, 2012), that is, approximately 180 million construction workers worldwide (WIEGO, 2014; Murie, 2007), made up of about 75% in developing countries. In South Africa, the construction sector employs approximately 8% percent of the total labour force (Statistics South Africa, 2014). The construction sector is therefore undeniably important in most economies of the world.

1.2 Construction H&S Performance

Despite its importance, the construction sector is unfortunately notorious for being one of the most dangerous industries (Murie 2007; Government of Queensland, 2013) along with transportation, mining and agricultural sectors. In comparison to other sectors, the construction industry has the highest rates of accidents, injuries and fatalities (Deacon, 2004; Government of Queensland, 2013; Musonda, 2012; Murie, 2007; AILS, 2012, Construction Industry Development Board (CIDB, 2009), being responsible for 30 – 40% percent of the world's fatal injuries (Murie, 2007). According to the International Labour Organization (ILO), one in every six work-related fatal accidents occurs on a construction site (CIDB, 2009). According to Health and Safety Executive (HSE, 2013), the sector accounts for 27% of fatal injuries and 10% of major injuries reported in Britain. In the United States of America, construction accounted for the highest number of fatal work injuries (775 in number) of all industries in 2012 (Bureau of Labour Statistics, 2013). In South Africa, statistics from the Federated Employer's Mutual Assurance Company show construction related fatalities total about 150 a year and the industry suffers about 400 accidents a year (Prinsloo, 2013). 258 accidents and 56 fatalities in construction were reported in 2012 (Department of Labour, quoted by Prinsloo, ibid.). These statistics indicate that the construction industry continues to have high incidences of accidents, injuries and deaths and this is grave and tragic because some of these injuries and accidents are avoidable and preventable even with proper nutrition.

1.3 The nature of construction

Construction work is hazardous in nature (ILO, 1995; Murie, 2007; Walters, 2010) and this is due to the extensive use of sophisticated, dangerous plants and machinery in construction

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operations. Furthermore, it is arduous (ILO, 1995; Murie, 2007), labour-intensive, physically and mentally demanding, requiring moderate to maximum levels of physical strength and stamina, manual dexterity and coordination (Construction Labour Contractors (CLC, 2014) as well as mental concentration and alertness, involving a wide range of hazardous work at varying and extreme heights and weather conditions, directly exposed to height, unsafe electrical wiring and appliances, and dangerous chemicals. This underscores the need for considerable attention towards workers' nutrition to help in preventing additional risks to that posed by the nature of their work.

In addition, construction is transient and informal. Being transient means that there is no central and permanent place of work (Government of Queensland, 2013). Construction activities do not last long at a particular site. The informality of construction with regard to employment means that workers are employed on a casual basis, without regular contracts or any social protection (Wells, 2007).

Construction workers perform the actual physical work, as opposed to site managers and supervisors. They are the most important resource and constitute assets in the construction industry (Smallwood, 2012). They are the human capital (Chenoweth, 2011; Deacon, 2004), centre and stronghold of the construction industry and as such they need particular care with regard to the need for continuous reduction of health risks and actualizing capacity and productivity (Deacon, 2004) in a key and important industry such as the construction industry.

1.4 The role of nutrition in industry performance

Poor nutrition potentially leads to the development of chronic diseases such as diabetes, cardiovascular disease, and certain cancers, raised levels of fatigue and reduced alertness that affect the safe operation of plant and machinery; reduced effectiveness and productivity of workers due to impaired physical and mental functioning, leading to project delays; increased rate of injuries (including an increased probability of slips, trips, falls and musculoskeletal injury) and absenteeism, leading to higher workers' compensation claims/premiums and skills shortages; accelerated health decline due to physical nature of the work, resulting in older workers with valuable skills and experience leaving the industry prematurely; increased rate of worksite incidents and near-misses, posing a risk to other workers on-site and affecting compliance with work H&S legislation (Government of Queensland, 2012a; 2012b and 2013).

2.0 Literature Review

2.1 Review of factors influencing construction workers' nutritional uptake

According to Wanjek (2005) construction workers' nutrition is influenced by availability and cost of healthy food alternatives on site or nearby, wages, work schedules (including length of meal breaks, since people generally don't make healthy food choices when they are rushed), work-

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related and welfare facilities (such as provision of eating areas) and economic environment. In his opinion, construction workers sometimes have no place to eat or money to purchase food; local and nearby restaurants can be expensive or in short supply and street foods are bacteria laden. In addition, the lackadaisical attitude of employers and unions towards nutrition was indicated to exacerbate the situation. Workers' access to food at construction sites was not a top union concern. Main concerns included wages, distribution of working time and non-unionized migrant workers. Construction employers on their part are usually more interested in maximizing productivity and profits (Deacon, 2004) and meeting tight deadlines, with little regard to their workers' wellbeing and health pursuits (Government of Queensland, 2013). Wanjek (2005) had a broad scope, including workers in general and focusing on food quality and quantity.

Thabit et al. (2013) found that lack of healthy dietary options in the workplace and low level of awareness among employees regarding healthy diet partly contributed to poor nutritional uptake amongst construction workers (in Ireland). The authors viewed that this lead to the prevalence of cardio metabolic disease risks such as obesity and diabetes amongst construction workers (Irish).

The Government of Queensland (2012b) identified work schedules, regular travel between worksites due to the transient nature of construction, and limited on-site catering facilities (e.g. a kitchen and/or healthy food) as environmental factors on a typical construction worksite which can influence workers' eating lifestyle. Regular travel between worksites means workers do not have a central workplace and may not be familiar with worksites long enough to participate in nutrition intervention programmes, and thus lack of nutritional awareness persists. However, this study focused on the environmental factors and excludes personal factors which could influence nutritional uptake on a construction site.

In another study, Du Plessis (2011) found that nutritional uptake of construction workers is influenced by nutritional knowledge and cooking skills, familial factors (socio-economic status of parents and parental influence), peer influence, food supply and acquisition (e.g., at home, work or through fast-food outlets) demographic factors (age and gender differences, income, ethnicity and cultural variables); dietary restraint (conscious choice to regulate body weight), work and financial responsibilities, unhealthy childhood and adolescent food practices which endure into adulthood. The other factors were found to be media and stereotypical views about nutrition (since men generally view nutrition and cooking as socially prescribed for women and are relatively unconcerned about health and diet). Findings from a similar study (Du Plessis, 2012) which explored these factors using focus groups and thematic analysis found that apprentices' dietary practices were moderated by convenience, availability and cost of foods, nutritional beliefs, significant others, colleagues in the workplace and body image. However, the studies by Du Plessis only focused on apprentices in the construction industry and therefore their results cannot be generalized.

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According to Tiwary et al. (2012), socio-economic status influenced nutritional uptake. The authors contended that since most building and construction workers (Indian) were bread-winners to large families and were poorly paid, their situation lead to regular consumption of staple foods inadequate in quantity and quality. Koehn and Reddy (cited by Agumba and Haupt, 2011) agreed that construction workers (Indian) had low income and could not afford proper nutrition. In addition to the low wages which construction workers earn owing to their low level of education and informality of employment (WIEGO, 2014), rising costs of essentials was reported to influence Indian construction workers' nutrition (Nadu, 2008). Foods consisting of refined grains, added sugars and fats, which are far more affordable than recommended "healthful" diets and of course, good tasting and convenient are usually opted for (Drewnowski and Darmon, 2005).

The Men's Health Forum (MHF, 2009) in the United Kingdom undertook research exploring the diet habits of male construction workers as an aspect of their health by reviewing existing evidence and speaking with industry stakeholders and construction workers themselves. This study revealed that construction workers have poor dietary behaviours due to limited on-site catering facilities (which seldom offer healthy alternatives or information about nutrition where they exist) and low level of nutritional knowledge. It was indicated that male construction workers had less knowledge of particular foods, are cynical about public health messages and reject healthy food on the grounds of poor taste and inability to satisfy. High-fat foods are instead consumed in the belief that this will enable them to undertake a physically-demanding job. This study however did not propose or advocate intervention measures, but suggested that men are more in need of interventions than women.

A cross-sectional study (Kolbe-Alexander et al., 2008) using focus groups and clinical measures indicated that insufficient time to prepare healthier meals at home and seasonality influenced dietary behaviours amongst South African employees. Participants felt that they generally followed healthier diets during summer when their intake of salads was higher and there was a greater variety of fruits and vegetables. Availability of healthy foods, a factor noted by Wanjek (2005) and Du Plessis (2012), on construction sites depends on the season. Kolbe-Alexander et al (2008) evaluated the effectiveness of an on-going workplace wellness programme which was conducted on South African employees, but not specifically on construction workers.

However, Kolver (2012), commenting on construction workers specifically, argued that many construction workers in South Africa have poor nutrition and this is due to lack of consistent access to healthy foods, lack of awareness of the poor nutritional value of the foods they eat regularly, long and time-consuming travels between workplaces, and financial constraints.

Literature reviewed in this section seems to suggest that some nutrition-influences are personal whereas others are environmental and as such, suggesting that they may be beyond an individual's control. Therefore, nutrition-intervention measures should target these factors

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individually and collectively to ensure effectiveness. This study sought therefore to establish and synthesize factors that influence construction workers' nutritional uptake.

2.2 Towards improving nutrition of construction workers

Workplaces should aim to implement programs and services based on the identification of solutions to the influences on workers' healthy eating, ensuring that all workers can get involved, access support and make changes to their lifestyle (Queensland Government, 2012b). A number of construction companies, organizations and governments have implemented initiatives to mitigate the impact of the above-mentioned factors and lead to positive outcomes for workers and the wider construction industry. The following intervention measures were identified from a review of various studies.

Supplementary feeding programmes: These are programmes primarily designed to distribute food among beneficiaries through the support of donors, agencies and local governments (FAO, 2001). For instance, according to Queensland Government (2012b), "fat-free Fridays" were offered as part of a health program (Your Health, Your Future) implemented through a collaborative partnership between construction unions and subcontractors, aimed to offer a health and wellbeing program tailored for construction workers. This program offered workers free healthy meals at onsite canteen over six months, during construction of the Gaston Correctional Centre. Evaluation at the end of the program which also included voluntary participation in health checks, individualized feedback and referral, monthly educational talks and seminars, demonstrated a 5-15% overall improvement in waist circumference, total cholesterol, blood glucose, physical activity levels and alcohol consumption; 25-35% overall reduction in blood pressure and nutrition scores; and a total group weight loss of 111.90 kilograms with an average loss of 3.6 kilograms per worker.

Evidence shows that fruit and vegetables interventions are generally effective at the workplace (Quintiliani, Poulsen & Sorensen, 2010). Initial results of studies in Denmark examining the impact of free-fruit program in the workplace showed that 96% of employees, when provided with fruit free or at 50% of cost, ate fruit daily or near daily; and the consumption of sweet snacks, fizzy drinks and candy declined by 50% (Anon., 2009).

According to Kolver (2012), in South Africa, workplace nutrition provider TRRC Nutrition provided workers in the construction industry as well as mining, forestry and agricultural workers, with energy-giving foods. These products, which are packaged according to the dynamics of a particular operation, are of high-quality nutrition and are affordable, compared with the cost related to accidents. This initiative helped to sustain workers, keeping them focused and alert and thus reducing accident rates and financial strain on companies with regard to accidents.

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Nutrition Education: Wanjek (2005) identified several workplace campaigns where education was key in motivating employees to eat well. He found that a lack of employee education led to employees rejecting healthy food offering to the extent that vendors refused to provide them anymore because they didn't sell. Groenveld et al. (2011) found that after six to twelve months of delivering individual counselling in the form of motivational interviews, there was a statistically significant beneficial effect on snack and fruit intake amongst male construction workers which was sustained 6 months after the intervention had ended. Another study (Anon., 2013) showed that three sessions of nutrition training and instructions (whereby basics about nutrients, cooking techniques and ways of increasing limited food resources, e.g., gardening were delivered) lead to increased vegetable intake, decreased "fast-food" intake and increased attention to food labels amongst low-income women who participated in the classes. In 2004, educating construction workers and managers on nutrition, and food safety and hygiene improved nutrition and health of Chinese construction workers in Beijing who got ill from food contamination as a result of improper handling of food and limited on-site catering facilities (Wanjek, 2005).

Environmental changes: Workplace environmental changes such as establishing designated areas for eating can improve nutrition at construction sites. Construction sites are dirty (ILO, 1995; Murie, 2007) and harbour debris and dangerous chemicals. Special areas like mess rooms on construction sites, not only provide shelter from the dirty environment and inclement weather, but also provide means of food preservation and storage. Wanjek (2005) opined that improving nutrition not only has to do with what people eat, but also how they eat; the environment/atmosphere/ambience in which they eat mattered greatly. Nutrition also has to do with food hygiene and safety. Lead could be ingested accidentally, leading to nausea, dizziness and muscle weakness, all of which can affect the working capacity of a construction worker and could be fatal. Again, some foods, especially proteins, stored at room temperature go bad quickly and cause ill-health (diarrhoea, for instance). Therefore provision of welfare facilities such as for washing before eating, safe drinking water, for preparing and eating meals as well as for food storage (refrigerator, cupboards and microwave) is very essential(ILO, 1995). Provision of canteens is vital for those who build canteens to prevent food contamination from site dust and tiny debris.

Improving access to healthy foods by ensuring that food vendors at construction sites sell a variety of healthy nutritious foods has been advocated (Wanjek, 2005; ILO, n. d.). If meals are not provided at the site, workers should be able to get reasonably priced and healthy foods nearby, as is the case in Japan (Wanjek, 2005), where convenience stores selling boxed lunches are ubiquitous and within walking distance of construction sites owing to Japan's dense population. Moreover, the traditional Japanese diet is among the healthiest in the world (Wanjek, ibid.).

Mapping out more time (by employers) for lunch breaks ensures that workers can have enough time to eat (Wanjek, ibid.). Workers who do not have enough time to eat could rely on snacks such as packet chips, sweets and fizzy drinks or burger and fries, instead of healthy lunches prepared at home with lots of vegetables and lean meat or fish or poultry.

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Nutritional Policies: Meal vouchers given by employers or governments (on a national level) can encourage workers to eat healthily. Food vouchers are meal tickets which can be used to purchase ready-to-eat meals in affiliated eating places. It is usually issued by the Government, enforced by law (Wanjek, 2005). Therefore, at the national level, the government has a responsibility to improve the nutrition of workers. In France, meal vouchers are commonly used by construction workers for particular restaurants selling healthy foods (Wanjek, ibid.). Construction employers can also work with food vendors on construction sites to provide and sell healthier and fortified foods at lower costs. Unsurprisingly, Steyn et al. (2009) share this view and argue in their South African study that nutrition interventions whereby changes are made with regard to increasing availability of healthy food options and selling at reduced prices, as well as involving dieticians in multi-media nutrition education programmes, proved to be successful in influencing positive dietary behaviours. In their review of lifestyle interventions in the workplace, Schroer et al. (2014) concluded that workplace health promotions should focus on either physical activity or weight or nutrition behaviour to maximize effectiveness.

In summary, to meet the need for proper meals of construction workers, facilities should be made available for boiling water and heating food and for vendors to sell hot and cold food (including provision of space, shelter, water, heating and rubbish bins); arrangements made with a canteen on site and/or restaurants nearby to supply cooked meals, packaged meals, snacks and beverages (ILO, n. d).

3.0 Research Methods

The study sought to establish what the factors which influence the predominant nutritional uptake of construction workers and what the possible interventions to improve the status quo could be. Consequently, a review of literature on practice and policies with regard to nutrition and H&S in the construction industry was conducted. Various sources were consulted in order to meet the objectives of the study. These sources include accredited academic and professional journals, books, government reports, newspapers, magazines, theses and dissertations. This paper will therefore report on findings from the study.

4.0 Discussions

This section discusses the objectives of the study and answers the research questions posed.

4.1 Factors influencing construction workers' nutrition

This paper identifies the following factors which influence the nutritional uptake of site workers in the construction industry:

- personal factors including preferences based on satiety and taste, level of nutritional knowledge, family and peer/colleagues' influences, ethnicity and cultural variables,

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income, lifetime unhealthy dietary habits, perceptions of value, motivation, convenience, nutritional beliefs, dietary restraint due to body image, and attitudes; and

- environmental factors including organizational influences (work schedules and length of break times), limited on-site eating facilities, wages, unvaried healthy food options on site, and availability and costs of healthy foods.

Some of these factors, like wages and work schedules are due to the informal and transient nature of industry and are therefore difficult to change, but their effects can be mitigated. Also, individuals have control over nutrition and can therefore make positive changes with regard to personal factors such as nutritional knowledge, habits and perceptions. These findings underscore the need for a comprehensive program targeting the nutrition of construction workers which can be modified to suit individual differences of the construction workforce stratified by age, gender and ethnicity.

4.2 Possible interventions to improve construction workers' nutritional uptake

The present paper identifies measures which could be tailored for construction workers and streamlined and targeted at improving their nutrition. These measures are nutrition education, supplementary feeding programmes, provision of nutrition facilities on site for food preparation and safety, ensuring adequate and varied healthy food alternatives to choose from, and nutritional policies (reduction of prices of healthier foods on site and offering meal vouchers can help to alleviate the problem of financial constraints arising from the low wages that construction workers earn).

Since individuals have different tastes and preferences, it is important to ensure access to varied healthy choices. Also, workers who are aware of the benefits of healthy eating will invariably make better food choices, when offered more access to healthy foods, compared to those who are not. In this regard, continuous nutrition training and instructions are indispensable in ensuring that workers are well informed about the benefits of proper nutrition in order to make the necessary changes in nutritional uptake. Workers need an understanding of what constitutes a good diet for health and the skills and motivation to make good food choices. Also, nutrition education will enlighten workers' unions about the importance of enforcing the rights to proper nutrition with respect to their members' health and site safety performance. Construction employers also need to be trained to enlighten them regarding the invaluable role of nutrition in H&S performance improvements.

5.0 Conclusion

The paper set out to establish the factors which could influence the nutritional uptake of construction workers as it appears that construction workers' predominant nutritional uptake is poor and moderated by various factors. The study also sought to establish feasible intervention

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measures to improve the status quo. The factors and possible interventions have been established. The objectives of the study have therefore been met.

There is a need to develop a nutrition-based intervention model for H&S focusing on construction workers and taking into consideration the personal and environmental factors which influence their nutrition. This is especially necessary in South Africa since it appears that very little has been done focusing on the nutrition of construction workers. These nutrition-influencers need to be dealt with individually and collectively to ensure effectiveness and sustainability.

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THE IMPACT OF MENTORING ON RETENTION OF EMPLOYEES IN THE CONSTRUCTION SECTOR THROUGH KNOWLEDGE TRANSFER: A LITERATURE REVIEW

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Abstract

The business world has long known and relied upon mentoring as a proven technique for developing in house talent, mentoring is experiencing resurgence because business leaders not only recognize the benefits of transferring knowledge among employees. Organizations today face a challenge regarding the mentoring and retention of key knowledge employees. Changing workforce demographics, marked by an aging labour force, more competitive recruiting and faster turnover among young employees are creating unprecedented knowledge retention problems in many industries, threating to reduce the capacity for innovation, growth and operational efficiency. The study describes better practices that organizations can use to address the threat of lost knowledge caused by changing workforce demographics. The study was mainly a literature review, qualitative with a special focus on the impact of mentoring on retention of employees within organizations. The data used in the report was mainly qualitative, based on the content analysis, and historical data. The study indicated knowledge transfer assists employees in improving their skill sets which increases their marketability and the potential for them to pursue career opportunities elsewhere. In addition mentoring relationships can assist organizations in addressing this challenge. On average the individual who had been mentored reported high levels of knowledge transfer, were more likely to report higher turnover intentions. The early success of the initiatives described provide useful lessons for the construction industry and executives who recognize that knowledge retention and mentoring of employees are critical for sustaining future organizational performance. Furthermore mentoring relationships may assist organizations in simultaneously promoting effective knowledge transfer and commitment that assist in the retention of key knowledge workers. Future research in this area is recommended to better understand how mentoring relationships may benefit organizations.

Keywords: Mentoring, Construction, Employees, Retention, Skill Development.

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1.0 Introduction

Organizations today face a dilemma regarding the retention of key knowledge workers. Knowledge transfer amongst employees is crucial for organizational productivity. Turnover is a critical human resource issue in all sectors of the economy. Turnover affects productivity, product and service quality, and profitability. The cost of replacing workers is high, finding skilled employees can be difficult, and investments in training are less secure. Unexpected workforce attrition may place employers at a serious disadvantage. And this turnover could occur when slimmed-down companies have little redundancy in job roles, exposing them to greater risk of losing important organizational knowledge. To minimize the impact of workforce turnover, companies need a proactive strategy for knowledge retention and transfer. Regardless of economic conditions, employee turnover happens. The financial impact of workforce mobility is well documented. The Society for Human Resource Management found that direct replacement costs can reach as high as 50% to 60% of an employee's annual salary. The total costs of replacement, including training and the loss of productivity, can range from 90% to 200% of an employee's annual salary (Society for Human Resource Management, 2008).

Turnover-related costs examined by the Saratoga Institute represented more than 12% of pre-tax income for the average company. As the rate of turnover increases, so does the cost per employee. For companies with greater than average voluntary attrition, turnover costs were equivalent to nearly 40% of company earnings (The Saratoga Review, 2007). While these figures do include the costs to train a new employee, they overlook the value of the organizational knowledge lost when employees leave. That value is difficult to quantify, yet organizational knowledge is fundamental to every company. When employees leave, they take a major competitive advantage with them. And they will leave. The workforce is poised for change. The confluence of current economic, generational and human influences on the workforce will cause a greater number of employees to shift in and out of jobs, departments and companies, draining organizations of critical skills and knowledge. People change jobs within a chosen profession six to eight times over a lifetime (Sales and Marketing Magazine, 2007). The increased number of job changes shortens the life cycle of an employee, putting companies at greater risk of organizational knowledge loss.

Companies may not have a solid understanding of the reasons employees leave. Saratoga Institute research cited by Leigh Branham indicates another conflict between the employer and employee perspectives: 89% of managers believe employees leave for money; 80-90% of employees leave for reasons other than money. Turnover is tied to employees 'unmet needs for trust, hope for the future, a sense of worth and a feeling of competence (Leigh, 2007). Employers cannot address a high turnover rate if they do not understand its root causes. As employees exit, those left behind may not be capable or willing to take on the additional responsibilities. They may already be overworked, or lack the confidence for a new role. When

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the only employee who knows how to run a legacy system leaves, coworkers may not want involvement with a technology or role they perceive will soon be obsolete. Companies can lose much more than full-time employees through attrition. The notion of a more-experienced individual providing knowledge and support to someone who is less-experienced has been in existence since Homer wrote his epic poem, *The Odyssey*. Mentoring is considered to be the oldest form of knowledge transfer (Stephenson, 1998).

For centuries, in agrarian and hunting societies, one was surrounded by many adults who served as occupational role models, i.e., mentors, and the knowledge that was passed down from these mentors benefited both the individual and the collective organization of which one was a part (Csikszentmihalyi & Schneider, 2000). The historic transition to a knowledge society (Drucker, 1993) concurrent with the rapid development of new technologies means that organizational success is dependent upon knowledge workers (Cascio & Aguinis, 2008; Drucker, 1993). The transfer of knowledge and the retention of key knowledge workers, thus, is critical to organizational competitiveness (Cascio & Aguinis, 2008; DeLong, 2004; Holtom, Mitchell, Lee, & Eberly, 2008). This requires organizations and researchers to focus more closely on processes such as mentoring that can support effective knowledge transfer and retention of critical knowledge workers. Organizations that rely upon effective knowledge transfer to sustain a competitive advantage face a dilemma. If such organizations do not have processes to promote effective knowledge transfer, productivity will suffer and organizational survival may be threatened (Szulanski, Cappetta, & Jensen, 2004). Conversely, if organizations do invest in knowledge transfer they risk increasing the marketability and job mobility of their employees which could potentially harm retention (Rousseau & Shperling, 2004).

Job mobility has increased in past decades because similarities in processes and technology mean that knowledge is less idiosyncratic to a particular organization and thus is more transferable (Rousseau & Shperling, 2004). To be effective, organizations must establish processes that promote knowledge transfer while simultaneously fostering a commitment to the organization that supports retention (Rousseau & Shperling, 2004).

2.0 Purpose of the Study

The purpose of this study is to contribute to a broader understanding of mentoring, mentoring relationships and their impact on individual and organizational outcomes. A significant percentage of the workforce, within the construction sector is nearing retirement age over the next ten years. These employees have acquired a tremendous amount of knowledge about how things work, how to get things done and who to go to when problems arise. Losing their expertise and experience could significantly reduce efficiency, resulting in costly mistakes, unexpected quality problems, or significant disruptions in services and/or performance. In addition, faster turnover among younger employees and more competitive recruiting and compensation packages add significantly to the mounting concern about the organization's

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ability to sustain acceptable levels of performance. This study will meaningfully contributes by sharing the wisdom and knowledge of transition to retirement employees to ensure corporate knowledge does not simply walk out the door, sharing the collective wisdom and knowledge of the build environment business.

3.0 Objectives of the study

- To investigate the dual nature of the effects of mentoring relationships through knowledge transfer.
- To evaluate the impact of mentoring on retention of employees within organizations.

4.0 Literature Review

Mentoring programs in organizations can be helpful in improving performance and transferring knowledge, and lead to higher job satisfaction and retention of employees, resulting in higher business productivity. In the workplace, relationships naturally develop between co-workers, clients, supervisors, and subordinates. Relationships at work can be both productive and unproductive, filled with animosity or admiration, and can foster friendships that go beyond the workplace lasting long into other careers and employers. One type of relationship that can be very beneficial in the workplace, even advancing an individual's career, is the mentoring relationship. The mentoring relationship between a mentor - a more experienced employee - and mentee can provide both parties benefits offering support and knowledge in performing a job, increased admiration in the office, and navigating the politics of an organization. The benefits usually relate to an increase in performance. This relationship, although usually positive, is not without some pitfalls and risks. A mentoring relationship can sometimes develop into a negative situation with a mentor possibly sabotaging a mentee or not providing the necessary career support (Piasecki, 2011).

The relationship an employee has with his/her peers, colleagues and company has a significant impact on knowledge retention and transfer. A positive relationship facilitates knowledge sharing during all phases of an employee's life cycle; a negative relationship or lack of a relationship can impede knowledge sharing, especially at the point of exit. The effect of mentoring relationship through knowledge transfer is that Knowledge retention and transfer is an area that holds great potential for companies in terms of reducing the costs associated with turnover, and perhaps more important, in sustaining business performance. Companies are recognizing it as a priority. According to Aberdeen Group, 61% of human resources executives and line of business managers surveyed rated 'capturing and transferring knowledge from those who have it to those who need it' as a top workforce-related challenge (Aberdeen, 2008). Companies are also recognizing that their knowledge retention and transfer strategies need work. A study by the Institute for Corporate Productivity found that a third of responding

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companies retain knowledge poorly or not at all when workers leave, while half think they're doing only "okay" at protecting organizational knowledge. Just two in ten think they are doing well or very well in knowledge retention (Institute for Corporate Productivity, 2009). Manpower's recent survey adds weight to these findings, 31% of employers indicated their organization does not have a proactive process in place to capture employees' job knowledge (Man Power Survey, 2010).

Mentoring relationships in the workplace may assist organizations in addressing this dilemma. One aspect of mentoring relationships is the passing of knowledge from a more-experienced individual, i.e., the mentor, to a less-experienced individual, i.e., the protégé (e.g., Levinson et al., 1978; Kram, 1985). Research in this area suggests that providing skill-building opportunities to protégés is positively related to personal learning in the workplace (Lankau & Scandura, 2002). Yet, an unintended consequence of knowledge transfer via mentoring is the potential for increased job mobility for protégés and the resulting negative effect on organizational retention efforts (Ramaswami & Dreher, 2007). A second aspect of mentoring relationships is the personal support that a mentor may provide in order to enhance a protégé's sense of competence and effectiveness (Kram, 1985). Recent findings from a longitudinal study suggest that mentoring fosters organizational retention in part because the emotional bond established between a mentor and a protégé may contribute to higher levels of organizational commitment (Payne & Huffman, 2005). Mentoring relationships may operate, thus, through a dual pathway to impact organizational retention by assisting in the transfer of organizational knowledge while simultaneously developing the high-quality interpersonal relationships that strengthen a protégé's commitment to an organization.

4.1 The Importance of Worker Retention and Knowledge Transfer

When a business loses employees, it loses skills, experience and "corporate memory". The magnitude and nature of these losses is a critical management issue, affecting productivity, profitability, and product and service quality. For employees, high turnover can negatively affect employment relationships, morale and workplace safety. The cost of replacing workers can be high, the problems associated with finding and training new employees can be considerable, and the specific workplace-acquired skills and knowledge people walk away with can take years to replace. The problem of turnover can be addressed through a variety of pro-active retention strategies: workplace policies and practices which increase employee commitment and loyalty. Knowledge transfer initiatives on the other hand, ensure that the knowledge and expertise of a company's employees its 'corporate memory'—are systematically and effectively shared among employees. They can offset the negative impact of turnover, but can also work pro-actively to reduce turnover by providing learning and skills development opportunities to employees - factors known to reduce turnover.

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Employee retention and knowledge transfer are two elements of a more general concern that might be best termed 'skills management,'—i.e., everything that has to do with recruiting, maintaining and developing *the necessary mix and levels of skill required* to achieve organizational and business objectives (Lochhead & Stephens, 2004).

5.0 Research Methodology

The study was mainly a literature review, qualitative with a special focus on the impact of mentoring on retention of employees within organizations. The data used in the report was mainly qualitative, based on the content analysis, and historical data

6.0 Findings and Discussion

6.1 The impact of mentoring on retention of employees within organizations

Though viewed as a key aspect of mentoring (Stephenson, 1998), knowledge transfer has been primarily examined at the interfirm level (Szulanski, 1996), at the interdepartmental level (Berta & Baker, 2004), and at the team level (Gibson, Waller, Carpenter, & Conte, 2007). Grover and Davenport (2001) suggest that much research on knowledge transfer has a more macro focus, examining the transfer of knowledge between and within organizations. Knowledge management articles highlight knowledge transfer as a key mechanism for organizational success, yet a gap exists between practice (Buckman, 1998) and formal research (Gallupe, 2001; Grover & Davenport, 2001). A key emphasis of research in knowledge transfer should be on the contribution of individuals to the process (Grover & Davenport, 2001). Little research in the knowledge management literature, however, has explicitly tested mentoring as a means by which knowledge is transferred among individuals (Gallupe, 2001).

Mentoring involves a formal or informal developmental partnership where employees receive information, advice, and guidance from an experienced professional, usually within the organization, who has expertise and a strong desire to help others grow in their jobs. Mentoring encompasses coaching, sharing perspectives, and transferring knowledge and wisdom to the mentee(s). The mentor is not a supervisor but a person with whom the employee can communicate freely and honestly without concern about being evaluated. Knowledge transfer is defined as an exchange of organizational knowledge between a source and a recipient (Grover & Davenport, 2001) in which the exchange consists of information and advice about resources and relationships (Szulanski, 1996). This definition suggests that structured information is combined with a recipient's experiences in order to create a capacity for action (DeLong, 2004). A primary mode of knowledge transfer is the direct sharing of knowledge between individuals (DeLong, 2004; Ford, 2002; Grover & Davenport, 2001) such as mentors and protégés.

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Knowledge is defined as a framework derived from one's experience, expert insight, and contextual information (Davenport & Prusak, 1998) and it assists in the evaluation and integration of new experiences and information (Grover & Davenport, 2001; Davenport & Prusak, 1998). Tacit knowledge, as originally defined by Polanyi (1966), is the knowledge of "…more than we can tell" (p.4). In contrast to explicit knowledge which can be clearly stated, tacit knowledge is highly personal and embodied in one's experiences, perceptions, judgments, and intuitions (Polanyi, 1966). Nonaka and colleagues (Nonaka & Takeuchi, 1995) applied the concept of tacit knowledge to business in order to better understand the role of knowledge as a competitive advantage in organizations.

6.2 Mentoring saves money, retains workers, builds leadership, and growth talent

Mentoring contributes to employee growth and tenure. In the long run, a well-organized and managed program can save the company thousands of Rands.

- **Reduced turnover and recruiting costs.** Mentoring relationships can help retain talented people because they have a stronger commitment to the organization (Jacka and Quin, 2010). Talent remains much less likely to leave if they feel supported in their work and made aware, for example, of new opportunities that their mentor suggests. It's not unusual for organizations to hear that their strong mentoring program attracted new talent.

- **Assistance in transferring knowledge from the retiring workforce to new workers.** Many mentoring relationships help younger employees learn from those who will retire soon. Pairing junior staff with more senior staff can reinvigorate the enthusiasm of senior employees as they transfer crucial knowledge to the next generation of workers. This reduces the loss of the tacit knowledge from seasoned veterans leaving the workforce.

- **Helping employees learn skills and gain knowledge.** Mentoring is an excellent example of informal learning, which is the way people learn 80% of the time in the business world (Schooley et al, 2010). A mentoring program reduces training costs due to the mentor/mentee informal learning relationship, which often deals with content one-on-one that otherwise would be covered in a formal course. It also brings new employees up to speed quickly in those first few months of employment. The chief learning and development officer in a global consulting firm confirms the value of mentoring as a learning tool: "People grow more with human interaction on the job, and we are trying to bring that to all our employees. The best way to learn is from a fellow professional."

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- **Assistance in career growth, building leadership capacity, and increasing bench strength.** Mentees can put their learning on a fast track with mentoring. If they're headed toward management, for example, the mentoring may focus on becoming a better leader and manager. When the mentor shares her own experiences, gives advice, and suggests readings, online courses, or other experiences to help other employees move toward their goals, she builds her own leadership skills in the process. Enhanced bench strength in company leadership ensures successful succession planning and increases productivity.

- **Increasing knowledge and insights about other employees.** Mentoring allows mentors to work with employees of different ages, backgrounds, values, styles of working, and professional expertise. This relationship breaks down barriers and informs mentees about other areas of the business. Mentors increase their employee network at different levels and know more about what's going on in the organization.

Failure to build employee loyalty now can become a ticking time bomb as external and internal forces work to prise the organizations most valued people resources loose. That's where mentoring comes in. Research into mentoring's impact on retention is consistent internationally. One of the most significant ways well-constructed mentoring programmes pay for themselves is by increasing the chances people will stay – by at least a third on average and in exceptional cases by over 1000 percent (Clutterbuck, 2011). Mentoring has this remarkable effect and impact on retention? Some of the mechanisms, which have been documented, include:

- It points people towards internal rather than external job opportunities. (On average, only one in five employees is likely to look first within their current employer for their next job; of people, who are in mentoring relationships, this proportion rises to nearly five out of five);
- It rekindles the enthusiasm of mentors, who may themselves have become disillusioned. Plateaued managers often gain a new lease of life in the organization as they see their efforts succeed in helping someone else's career. Revitalizing plateaued managers is one of the forgotten engines of corporate recovery; and
- It attracts back talented employees, who have left to join other employers. When these people start to look for their next move, the first person they may talk to is a previous mentor, who they trust and whose opinion they respect.

Protégés consider a mentor's "willingness to share knowledge and understanding" as the most important aspect of a mentoring relationship (Roche, 1979, p.24). One of the primary reasons for difficulties in knowledge transfer between organizational units is the lack of a personal bond. Mentoring relationships are a critical factor in the success of

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knowledge transfer; mentors can assist protégés in acquiring both the explicit and tacit knowledge needed to gain competency and to accomplish tasks (Crocitto, Sullivan, & Carraher, 2005; Von Krogh, Ichijo, & Nonaka, 2000). Mentoring relationships can provide the opportunity and time for social interaction that permits the transfer of knowledge not easily expressed in words and numbers. Protégés are able to develop competencies when their mentors transfer knowledge to them through training, development and performance feedback. An in-depth understanding of the mentoring functions explains, in part, how the mentor actively passes knowledge to the protégé so that the protégé gains the expertise that will benefit himself/herself and the organization.

Research suggests that protégés benefit from the skills and knowledge transferred to them from their mentors. Outcomes from knowledge transfer included networking opportunities with key managers, a broader understanding of the organization, and increased knowledge about protégés' particular job functions. The receipt of career-related mentoring functions positively influenced protégés' organizational and professional knowledge (Kowtha & Tan, 2008).

6.2.1 Performance

The purpose of knowledge transfer is to pass information from the more- experienced to the less-experienced employees so that the less-experienced employees can build the capabilities needed to assume future roles in the organization (DeLong, 2004). Although mentoring research has focused on career-related outcomes that are important to protégés, there is a need to explicitly examine the mechanisms by which mentoring influences outcomes. Research at both the organizational and individual level of analysis appears to support the notion that knowledge transfer mediates the relationship between mentoring and performance.

Building upon Kammeyer-Mueller and Wanberg's (2003) work, Kowtha and Tan (2008) found that knowledge of the organization and profession mediated the relationship between career-related mentoring and the ability to perform. They suggested that task mastery is achieved by the transfer of tacit knowledge through interpersonal interaction. In addition, receipt of mentoring functions was related to the perceived positive influence on one's job performance. Based on these studies, one may infer that mentoring will positively impact a protégé's job performance through knowledge transfer.

6.2.2 Retention

As an outcome of mentoring relationships in workplace settings, retention is of interest in this study because of its importance to organizational performance. For decades, management researchers have emphasized the importance of retaining talented employees through research on turnover. If organizations invest in talented employees

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through increases in their knowledge, the knowledge transferred to these employees is lost if they leave the organization, and the investment made in them. While recognizing that there will always be some voluntary turnover in an organization, retention rates should be somewhat high so that experienced workers are available to share their organizational knowledge with newcomers in the organization and to use their expertise to directly benefit their organization. Thus, in the knowledge economy, it is important to look at issues of retention (Mitchell et al., 2001).

Organizations face significant challenges in retaining valued employees because of the changes in the employment relationship that promote greater job mobility. Traditional research has focused on the influence of job satisfaction on voluntary turnover (Mitchell & Lee, 2001). While the implication of such research is that workers dissatisfied with their jobs will leave and those satisfied with their jobs will remain, researchers suggest that this view is too simplistic and narrow in explaining what influences turnover and retention (Mitchell & Lee, 2001). To develop alternative theoretical understandings of voluntary turnover and retention, researchers have expanded upon the initial research to explore other constructs. Recognizing that "… less turnover research has focused specifically on how an employee decides to remain with an organization and what determines this attachment" (Mitchell et al., 2001), researchers are beginning to recognize the importance of relationships in retaining workers (Mitchell et al., 2001.

Mentoring is a type of workplace relationship that may assist in promoting the retention of knowledge and talented knowledge workers. Protégés who reported receiving mentoring were more likely to indicate that they did not have plans to leave their organization to go and work in another organization. Increases in knowledge work in today's dynamic workplace require organizations to focus on the retention of talented and potential employees. Knowledge workers are increasingly more important for organizational competitiveness today so the knowledge transfer between employees and the retention of key employees is critically important. Organizations that have not been concerned with retention in the past, however, are now struggling to keep their skilled employees. In professions heavily dependent upon knowledge transfer such as medicine, engineering, and chemicals manufacturing, the pool of skilled workers is shrinking; thus, there is increased competition for the available workers (DeLong, 2004). Organizations with higher levels of mentoring had lower turnover; moreover, they suggested that the mentoring specifically assisted in developing protégés' knowledge and skills. Based on the above research, one may posit that the knowledge and feedback provided to a protégé by a mentor may influence the protégé's turnover intentions. Yet these studies have not investigated the potentially negative effects of mentoring on retention because of knowledge transfer. The researcher expects that knowledge transfer will mediate the effect of mentoring on organizational retention. The type of knowledge transfer to protégés may influence their intentions to remain within an organization. If a mentor transfers knowledge that is specific to the organization (i.e.,

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organizational practices and relationships), then the protégé will be more likely to remain with the organization because the knowledge cannot be applied elsewhere. Based on the above, the researcher proposes that knowledge transfer will mediate the relationship between mentoring and protégés' intentions to remain with their organization.

6.2.3 Best practices in retention and knowledge transfer

In order to address the threat of lost knowledge caused by changing workforce demographics, the heart of any knowledge-retention strategy is its knowledge- sharing practices. There are many sorts of methods that contribute to knowledge capture, sharing and re-application: after-action reviews, communities of practice, face-to-face meetings, mentoring programs, expert referral services, training, video conferencing, interviews, written reports, etc. While many of these practices are helpful for creating a general knowledge- sharing environment, the question remains which ones are most useful for addressing knowledge-retention problems?

A review of the HR literature suggests that sources on HR retention can be grouped into the following categories:

- "How To" articles, books and presentation materials on employee retention. By far the most numerous, these sources tend to be highly prescriptive without delving too deeply into specific details about how to implement retention measures.

- Case studies of particular companies that primarily relate what a particular establishment has done with little or no reference to more general sources within the HR literature.

- Works that focus more intensively and exhaustively on specific retention areas. The literature on compensation and benefits systems, for example, is quite considerable.

- A comparatively small body of academic and business literature in which various research methodologies are used in an attempt to link particular HR initiatives to measurable performance outputs such as productivity, worker turnover, etc.

Based on the review of the literature, the list of retention practices that captures the main types of interventions discussed in the HR literature. They are as follows (Lochhead & Stephens, 2004):

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Competitive and Fair Compensation is a fundamental starting point in most strategies to attract and retain employees. However, there is general agreement that compensation levels do not single-handedly guarantee employee retention. Common best practices include the use of industry surveys to benchmark and position wage and salary structures to be fair and competitive.

Adequate and Flexible Benefits can demonstrate to employees that a company is supportive and fair, and there is evidence to suggest that benefits are at the top of the list of reasons why employees choose to stay with their employer or to join the company in the first place. Many companies are responding to the increasingly diverse needs of their employees by introducing a greater element of choice in the range of benefits from which their workers can choose. Flexibility in benefits packages can enhance retention, as it creates responsiveness to the specific needs and circumstances of individual employees.

Innovative Compensation Systems and practices can have a positive impact on employee retention by motivating membership-oriented behavior (commitment). Pay systems may also affect knowledge sharing and transfer if sharing, teamwork, suggestions, etc. are rewarded or recognized. Innovative compensation systems include gain sharing, skill-based pay and various types of bonus plans.

Recognition and Rewards include a diverse range of formal and informal, financial and non-financial, incentives given to individual employees, groups of employees or to an entire staff. They include such things as employee of the month awards, company- sponsored sports teams and social events, prizes, clothing, and so on. Recognition and rewards can contribute to a workplace culture of respect and appreciation for employees and work well done, and thereby reinforce employee commitment to the firm.

Training, Professional Development, and Career Planning are effective ways to enhance employee retention. Training constitutes a visible investment that the company makes in the worker, providing him or her with new skills, and greater competencies and confidence. Training often leads to work that is more intrinsically rewarding. Combined with effective communication about how an employee's efforts at developing skills will lead him or her to more challenging and meaningful positions *within* the company, training encourages workers to make longer term commitments to their workplace: it permits them to see a future with the company. *All* of the companies we interviewed were very active in the area of skills training and professional development. Many have put in place effective internal promotion programs that allow even their unskilled and semi- skilled workforce to move towards positions of greater responsibility and remuneration within the company.

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Healthy Workplace or Wellness Initiatives take on a variety of forms, including those directed at the physical work environment (cleanliness, safety, ergonomics, etc.); health practices (supporting healthy lifestyles, fitness, diet, etc.); and social environment and personal resources (organizational culture, a sense of control over one's work, employee assistance programs, etc.). Healthy workplace initiatives not only improve the health and well-being of individual employees, but contribute to business performance objectives including employee retention.

Performance Appraisal practices that provide good feedback to employees and give them a view of their longer-term progress within the company — particularly in terms of training and career development opportunities — are important ways of enhancing employee commitment.

6.2.4 Knowledge Transfer – cross-training, coaching and mentoring, phased in retirement.

While employee retention practices seek to retain *workers*, knowledge transfer practices seek to retain *skills*, through both formal and informal exercises in information sharing and the building of collective knowledge. Mentoring and coaching, phased-in retirements, and cross-training and job rotation, are types of knowledge transfer that overlap with training. Knowledge transfer also includes the use of technology-based tools—databases, intranets, groupware—aimed to support knowledge sharing among individuals, and to permanently document and keep knowledge that is vital to business performance.

7.0 Conclusion

Retaining organizational knowledge in the face of changing workforce demographics is a complex challenge that requires simultaneously confronting the problems created by an aging workforce, a shrinking talent pool and increasingly restless employees. The threats posed by changing demographics were not created in a year and will not be solved overnight. The most effective knowledge retention strategies will require a multifaceted approach and a long-term commitment on both the leadership of an organization and the employees. Because knowledge is a key resource today, a more systematic understanding of how knowledge is shared and transferred in organizations is needed in order for organizations to be able to better manage it. Organizations must understand the types of processes that facilitate effective knowledge transfer between individual employees, while simultaneously retaining knowledge in the organization so it can benefit the organization and employees. This study is one of the few empirical research efforts to shed light on this process.

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Results of this study suggest that a focus on mentoring simply as a vehicle to promote knowledge sharing may harm an organization as the more talented employees may "jump ship." Attention must also be given to understanding the mentoring behavior's that foster a protégé's affective commitment so as to mitigate the potentially negative effect of knowledge transfer on retention. The provision of mentoring functions to protégés in an organization may assist an organization in meeting two critical goals for ongoing effectiveness: knowledge sharing and retention.

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ASSESSMENT OF CLIENTS/CONTRACTORS CHOICES IN THE SELECTION OF SUBCONTRACTORS IN LAGOS STATE, NIGERIA

Richard Jimoh[1], Augustine Ijigah[2] and Austine Oyibo[3]

Abstract

Considering that various activities of work are being carried simultaneously on site, it becomes imperative to scrutinise the subcontractors capability in handling projects in terms of planning, timely delivery, minimal supervision among others in order to maximise productivity. The success of a project is hinged to a large extent on how subcontractors are engaged and managed by the clients and contractors depending on who engaged them. To this end, the study assessed clients and contractors choices in the selection of subcontractors in Lagos State through the self-administration of 100 structured questionnaires using convenience sampling technique. In addition to this, eight (8) subcontractors were interviewed using structured interview method. It was discovered that 46.2% of the respondents' used selective tendering during the selection of subcontractors. Quality standard, competence resulting in minimal supervision and experience of subcontractors ranked 1st, 2nd and 3rd respectively in the overall rank by the respondents. In a related development, subcontractors determine the need of clients in terms of cost, time, quality and safety parameters when engaged by clients. In order to improve contract administration, subcontractors' selection should be based on proven track record as this will have effect on the quality of work done, extent of supervision expected by the contractors on the subcontractors.

KEYWORDS: Client, Contractor, Subcontractor, Selection, Tendering

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2.0 Introduction

The construction industry has been affected due in part to recession, fickleness of the market situation, effects of new technological advancement and the global competitiveness arising from market liberalisation. This has resulted into changes in the way and manner of doing business within the industry; the strategies adopted in the 60s up to the 80s have to be changed now in order to keep with the new operating conditions. Construction firms are now seeking for greater flexibility in order to be relevant and competitive (Edum-Fotwe, McCaffer & AbdMajid, n.d.). The adoption of these strategies by large construction companies according to Edum-Fotwe *et al.* (n.d.) could be seen from the type of relationships developed by these companies with suppliers resulting in the relying on functions such as outsourcing and subcontracting usually performed by small sized contractors. The construction sectors of most countries have been restructured in such a way that subcontracting has become widespread in different areas of the industry than it was in the past (Creed, Seon and Joon 2008). Shimizu and Cardoso (2002) identified subcontractors as specialists in the performance of a distinct job, and may also be engaged for the supply of personnel, materials, equipment, tools, and designs depending on the speciality of the subcontractor. The primary function is to help the main builder lighten the load of full construction work by sharing it among the subcontractors (Pietroforte and Costantino, 2003).

In a related development, Beardsworth et al. (1988) opined that by subcontracting portions of the work, the main contractor is freed of the administrative tasks relating to the recruitment, deployment and supervision of workers. The critical importance of subcontracting to the success of construction projects has been recognized (Dainty et al., 2001). For instance, Debrah & Ofori (1997) concluded that subcontracting enables general contractors to keep a limited nucleus of full-time employees, maintaining costs and yet being able to engage the necessary skilled craftsmen. Debrah & Ofori (1997) argued that subcontractors facilitate the work of the general contractors through the provision of quotations for the subcontracted works. Kale and Arditi (2001) stressed that big construction firms now prefer to be flexible rather than maintaining a large organization to undertake the entire construction process as a rational response to the instability of demand in the construction market. Wong (1990) submitted that subcontractors could work faster than directly employed labour because their profit is only realized if they complete the work within the budget.

Knutson *et al.* (cited in McCord & Gunderson, 2013) stated that the project features determine the type and how capable the subcontractor needed for a given job. Each project has a unique combination of job-specific subcontractors that are typically assembled under a general contractor acting as the head (McCord & Gunderson, 2013). The costs, time and quality of specialist subcontractors is very important because it has a direct bearing on the performance of the prime contractor on key elements of the work (Sohail, 1999). Clients and main contractors of the construction industry have measures for assessing subcontractors' performance depending on the type of projects and other related factors. According to Seeley (1996), the traditional

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project performance measures of cost, time and quality are frequently used to measure contractors' performance by clients on one hand and subcontractors' performance by main contractors on the other hand.

Wong & Cheah (2004) stated that subcontractors are mostly faced with various problems ranging from Inconsistencies on the terms and conditions of agreement with the main contractor; co-ordination, integration, interfacing of subcontractors' works and the main contractors' works; defects and design of work done by subcontractors; unsatisfactory arrangement on terms of payment for sub-contracting work to lack of understanding on the implication of the sub-contractor's work onto the main building contract work. Similarly, Lohand Ofori (2000) indicated that many subcontractors lack qualification and proper training. In a related development, Ng, Skitmore and Chung (2003) stated that the outcome of the project in terms of the quality can be jeopardised if the subcontractors employed are not capable or are not experienced enough. It is on the basis of this that the study set out to assess the clients/contractors choices in the selection of subcontractors in Lagos State with a view to improving contract administration.

2.0 Methodology

Survey method was adopted through the self-administration of 100 structured questionnaires to contractors and clients using convenience sampling technique in Lagos state. In addition to this, eight (8) subcontractors were interviewed in order to determine the needs of both the clients and contractors depending on who the employers are. Eighty questionnaires (65 from the contractors and 15 from the clients) representing 74% were returned and appropriately completed. The selection criteria were ranked using a 5-Point Likert Scale, where 1 is the least important and 5 is the most. The questionnaires were analysed using Means Scores (MS) Relative importance index (RII) and Mann-Whitney U test that formed the basis for the conclusion reached and the recommendations made.

The Mean Score (MS) analysis was used to rank selection criteria of both contractors and clients groups. The mean score (MS) is given as follows after (Odeyinka *et al.* 2011).

$$MS = \frac{5n_5 + 4n_4 + 3n_3 + 2n_2 + 1n_1}{(n_5 + n_4 + n_3 + n_2 + n_1)}$$

Where n1 = number of respondents who answered "very low" "very poor"

n2 = number of respondents who answered "low" "poor"

n3= number of respondents who answered "average"

n4 = number of respondents who answered "high" "good"

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n5 = number of respondents who answered "very high" "very good"

The Relative Importance Index (RII) method (Kometa *et al.* 1994) was used to calculate the significance of each category's rank. The RII is computed as: RII = $\frac{\sum W}{AxN}$

Where *W* is the weight given to each factor by the respondents and ranges from 1 to 5; *A* is the highest weight = 5; and *N* – the total number of respondents

3.0 Results and discussion of the questionnaire survey

The table below shows the different years of experience of respondents that were involved in this research. The years of experience of 1-5 accounts for 23.8% of the respondents, the years of experience of 6-10 accounts for 16.2%, the years of experience of 11-15 accounts for 15% of the respondents, the years of experience of 16-20 accounts for 11.2% of the respondents and the years of experience of above 20 account for 33.8% of the respondents.

Table 1: Years of experience in the construction industry

Year	Frequency	Percentage
1-5	**19**	**23.8**
6-10	**13**	**16.2**
11-15	**12**	**15.0**
16-20	**9**	**11.2**
Above 20	**27**	**33.8**
Total	**80**	**100**

Source: Field survey, 2013

Prequalification of subcontractors is known to be an essential component during the selection of a contractor. Table 2 below illustrates how the respondents perceive the idea of prequalifying subcontractors during selection process. Those who prequalify subcontractors during selection accounts for 56.2% while those who do not account for 43.8%.

Table 2: Prequalification of subcontractors

Prequalify	Frequency	Percentage
Yes	**45**	**56.2**
No	**35**	**43.8**
Total	**80**	**100.0**

Source: Field survey, 2013

The tendering method employed during tender process is usually vital to the success of the selection of a suitable subcontractor. Table 3 reveals the tendering method that the respondents

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apply when selecting a subcontractor. Those that often use open tendering accounts for 18.8%, those that often use selective tendering accounts for 46.2%, those that often use negotiated tendering accounts for 28.8%, those that use both selective and negotiated tendering account for 3.8% and those that use both open and selective tendering accounts for 2.5%.

Table 3: Tendering methods/types often used

Tendering method	Frequency	Percentage
Open tendering	**15**	**18.8**
Selective tendering	**37**	**46.2**
Negotiated tendering	**23**	**28.8**
Selective and negotiated tendering	**3**	**3.8**
Open and selective tendering	**2**	**2.5**
Total	**80**	**100.0**

Source: Field survey, 2013

It is not surprising that quality has the highest mean score of 4.65 followed by safety with mean score of 4.21 as indicated in Table 4 below. The predominant tendering type used by the respondents is selective tendering (46.2%) which may be an indication that subcontractors are selected based on the quality of job expected from them and their concern for safety issues.

Table 4: Influence of tendering type used on cost, time, quality and safety

Likert item	Mean score	Ranks
Quality	**4.65**	**1**
Safety	**4.21**	**2**
Time	**4.20**	**3**
Cost	**3.83**	**4**

Source: Field survey, 2013

From Table 5, factors such as quality standard, competence, good team spirit, size of project and follow up service are the five factors that top the ranking of the clients when selecting subcontractors having mean scores of 4.69, 4.31, 4.23, 4.23 and 4.15 respectively. The lowest tender is ranked the least hence submitting the lowest tender may not be a guarantee that the subcontractor will get the job.

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Table 5: Selection criteria for clients

Factors	Mean score	RANK
Quality standard	4.69	1
Competence, hence minimal supervision required	4.31	2
Good team spirit	4.23	3.5
Size of project	4.23	3.5
Follow up service	4.15	6
Experience of subcontractor	4.15	6
Work within budget	4.15	6
Honesty/Trust worthy	4.08	8.5
Price competition	4.08	8.5
Works within time	4.00	10
Safety education	3.92	11.5
Safety procedures	3.92	11.5
Complexity of work	3.85	14
Good working relationship with other subcontractors	3.85	14
Well trained	3.85	14
Client's involvement	3.69	16.5
Past experience with subcontractor	3.62	16.5
Lowest tender	3.15	18

Source: Field survey, 2013

The contractors' selection criteria in terms of ranking are different from that of the clients. To the contractors, factors such as experience of subcontractor, quality standard, work within budget, competence and work within time are ranked the 1st, 2nd, 3rd, 4th and 5th respectively. In a related development, client's involvement and good working relationship with other subcontractors are ranked the 17th and 18th respectively.

Table 6: Selection criteria for contractors

Factors	Mean score	RANK
Experience of subcontractor	4.528	1.5
Quality standard	4.528	1.5
Work within budget	4.471	3.5
Competence, hence minimal supervision required	4.471	3.5
Work within time	4.342	5
Well trained	4.300	6
Price competition	4.228	7

Source: Field survey, 2013

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Continue Table 6: Selection criteria for contractors

Lowest tender	4.028	8
Size of project	4.014	9
Past experience with subcontractor	3.908	10
Honesty/Trust worthy	3.814	11
Safety procedures	3.828	12
Complexity of work	3.757	13.5
Follow up service	3.728	13.5
Safety education	3.585	15.5
Good team spirit	3.542	15.5
Good working relationship with other subcontractors	3.485	17
Client's involvement	3.257	18

Source: Field survey, 2013

Table 7 above shows the overall ranking of factors affecting the choice of contractors/clients in the selection of subcontractors. 'Quality standard' is ranked first with a relative importance index of 0.94, 'competence hence minimal supervision' is ranked second with a relative importance index of 0.92, 'experience of subcontractor' is ranked third with a relative importance index of 0.91, 'well trained' is ranked fourth with a relative importance index of 0.91, 'works within budget' is ranked fifth with a relative importance index of 0.90. On the other hand, factors such as complexity of work, safety education, good working relationship with other subcontractors, client's involvement and follow up service were ranked 14th, 15th, 16th, 17th and 18th respectively with a relative importance index of 0.75, 0.74, 0.72, 0.66 and 0.63. The factors ranked 1st, 2nd and 3rd are consistent with the study of Fagbenle *et al.* (2011) and Maloney (2002), the factor ranked 9th is consistent with Maloney (2002).

Table 7: Overall ranking of factors influencing the selection of subcontractors

Factors	**RII**	**Rank**
Quality standard	**0.94**	**1**
Competence hence minimum supervision required	**0.92**	**2**
Experience of subcontractor	**0.91**	**3.5**
Well trained	**0.91**	**3.5**
Works within budget	**0.90**	**5.5**
Price competition	**0.90**	**5.5**
Works within time	**0.88**	**7**
Size of work	**0.81**	**8**
Past experience with subcontractor	**0.79**	**9**

Source: Field survey, 2013

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Continue Table 7: Overall ranking of factors influencing the selection of subcontractors

Honesty/trustworthy	0.78	10
Safety procedures	**0.77**	**11.5**
Lowest tender	**0.77**	**11.5**
Good team spirit	**0.76**	**13**
Complexity of work	**0.75**	**14**
Safety education	**0.74**	**15**
Good working relationship with other subcontractors	**0.72**	**16**
Client's involvement	**0.66**	**17**
Follow up service	**0.63**	**18**

Source: Field survey, 2013

Mann Whitney U test was carried out to determine statistically if there is a difference in the responses of both the clients and contractors groups. The result of the test in table 8 shows that there is no statistical difference in the responses of the two groups. This is consistent with Fagbenle *et al.* (2011) that irrespective of the criteria used in the selection process, the responses of the two groups will be similar.

Table 8: Mann-Whitney U test for clients and contractors means scores

Attribute	**Means scores**	**$U_{obtained}$**	**$U_{critical}$**	**Decision**
Clients	326	155	99	Not significant
Contractors	340	155	99	Not significant
Item size (N)	18			

4.0 Summary of the results of the interview conducted with subcontractors

Table 9 gives an insight into the type of projects usually handled by the subcontractors interviewed. Twenty-five (25.0%) are involved in building works. While 62.5% handled civil engineering works and 12.5% handled both building and civil engineering works.

Table 9: The nature of projects executed by the subcontractors

Nature of project	**Frequency**	**Percentage**
Civil engineering works	5	62.5
Building works	2	25.0
Civil engineering and building works	1	12.5
Total	8	100.0

Source: Field survey, 2013

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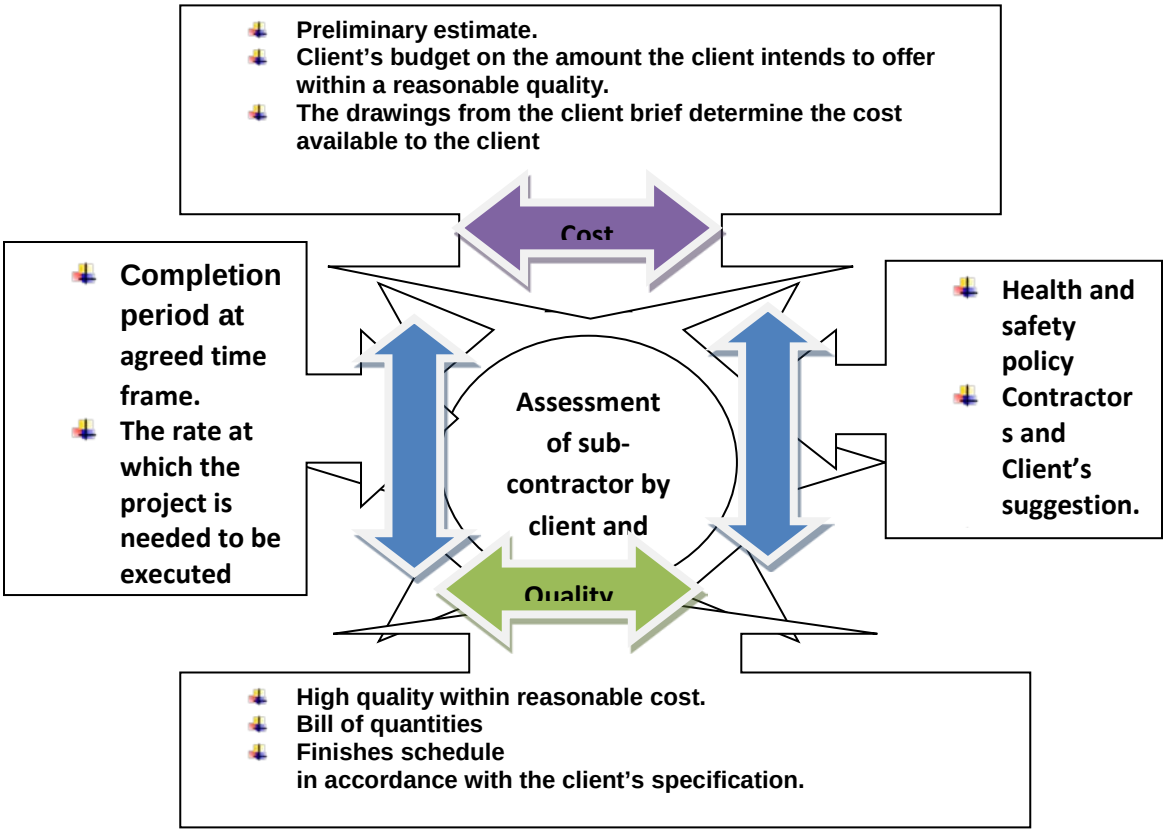

Fig 1: Subcontractors perception of the criteria used by clients and contractors in their selection of subcontractors

5.0 Conclusion

The paper assessed the selection criteria in the choice of subcontractors by both the clients and contractors, it can be seen that the selection criteria for the two groups are not the same though they are not statistically different based on Mann-Whitney U test carried out. However, quality standard and competence are among the five highest ranked criteria by the two groups. This may be the reason why selective tendering is the type of tendering adopted by majority of the respondents (46.2%). It is therefore advocated that the 1st to 5th criteria in Table 7 should always form part of the selection criteria to be adopted in the selection of subcontractors by the clients and contractors in order to improve contract administration in the study area.

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EVALUATION OF THE IMPACT OF ORGANISATIONAL CONTINGENCY FACTORS ON FIRM PERFORMANCE

Luqman Oyekunle Oyewobi[1], Abimbola Olukemi Windapo[2] and James O. B. Rotimi[3]

Abstract

This paper examines and proposes a model for improving the performance of construction organisations. The purpose of this study is to evaluate the relationship between organisational characteristics, competitive strategies and performance of construction organisations. The study investigates a sample of large construction firms listed in both civil and general building class of works on the Construction Industry Development Board (cidb) register of contractors in South Africa using quantitative approach. The analysis conducted on sample of 72 construction organisations reveal that differentiation strategy influences firm performance in complex and dynamic environment while cost-leadership is advantageous in less dynamic or stable environments. In addition, it was revealed that organisational structure only has a direct impact on performance when moderated by competitive strategy. This study is investigative in nature and focuses on large construction organisations; therefore, the results may not be generalizable to a larger population of SMEs in the industry. Further research is required to complement this study with larger sample size, and cluster the firms to identify different strategic groups that exist in the industry.

Keywords: contingency, competitive strategy, organisational structure, performance, South Africa.

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1.0 Introduction

Ever since the publication of Porter's (1980) and 1985 landmark research “Competitive strategy” and “competitive advantage creating and sustaining superior performance” respectively, there has been a strong debate in strategic management field whether the proposed generic competitive strategy, i.e. differentiation, cost-leadership and focus are mutually exclusive. Attempts have been made by researchers to ascertain whether organisation can only pursue one of the strategies or combination of the strategies to achieve superior performance (Dess and Miller, 1993; Allen and Helms, 2006). However, Parker and Helms (1992) contend that irrespective of an organisation’s choice of strategy, it must be strategically fit with the overall objectives of the business in achieving superior performance. Porter (1980; 1985) reiterates that these strategies are pertinent in all industries in most countries and necessary for gaining competitive advantage in order to become an industry leader.

In spite of this assertion, the practice of strategic management within the construction industry has been a low-key activity (Price, Ganiev and Newson, 1993), but because of persistent change in the construction organisations business environment, organisations become more aware strategically (Chinowsky and Bryde, 2001; Price *et al*., 2003). As a result, many construction organisations are now becoming preoccupied with strategic approaches in the deployment of resources to tasks and also in overcoming the threats in the environment as well as exploiting the opportunities (Junnonen, 1998; Price *et al*., 2003). However, to compete successfully and develop sustainable competitive advantage, viable organisational characteristic is a prerequisite and it plays a pivotal role in organisational objective achievement. Organisational characteristics in this study are operationalised in terms of the decision-making structure, decision-making style and styles of management. This is because in an uncertain and hyper-competitive business environment like construction, for an organisation to stay competitively relevant and survive, decisions have to be made, a structural pattern for disseminating the decisions is required by using an appropriate management philosophy in implementing the strategies formulated (Price, 2003).

In riposte to this, this study develops and validates a generic and integrative, performance model linking the organisation-environment interface as well as competitive strategies. The study utilises Partial Least Square Structural Equations Modelling, which allows concurrent investigation of general relationships among environmental and organisational variables as well as of their combine and independent impacts on performance. Therefore, the objective of this study is to: (i) to examine the nature of relationship between organisational characteristics and performance; and (ii) to investigate the influence of environmental factors in moderating the strength of relationship between competitive strategy and organisational performance.

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1.1 Theoretical foundation

The concept of strategy has been discussed variously in literature using different theoretical approaches and research methodologies to identify the strategy-performance linkages (Allen and Helms, 2006). One of the prominent among these theories is the industrial organization (IO) theory, rooted in industrial economic of structure-conduct-performance paradigm. The IO theory argues that industry competitors have fairly analogous strategies, resources and competencies, and that Organisational performance in terms of profitability is a function of the industry structure where it operates (Porter, 1980; Allen and Helm, 2006). Porter's generic competitive strategies align with this theory and argue that industry with positive or constructive structure provides the best opportunities for organisation to multiply its profitability, because its performance is measured by level of success achieved within the industry (Porter, 980; Parnell, 2013). Porter (1980; 1985) asserts that organisation can develop competitive advantage to maximize profit through superior performance by adopting any of the generic competitive strategies. However, in the past few years, strategy researchers have re-aligned their efforts and begin to look beyond industrial organisation based perceptions of competitive strategy by striving to have a better knowledge of how organisations achieved sustained competitive advantage (Barney, 2011; Chan, Shaffer & Snape, 2004; Mahoney and Pandian, 1992). Structural contingency theorists argue that organisations that achieve beneficial fit with its environment will exhibits higher performance than those that misfit (Donaldson, 2001; Parnell, 2013).

Donaldson (2001) contends that the strategic component of structural contingency theory is that organisational performance results from a fit between characteristics of structure of the organisation and the contingency factors relating to environmental issues. The contingency theory claims that there is no any universal form of configuration that fits all situations, and that each organisation needs to obtain beneficial fit with contextual or environmental factors, its structural features, as well as strategies to be formulated. However, most of these existing theories on strategies are from the mainstream strategic management field and of which the characteristics of the construction industry are not quite similar (Cheah and Garvin, 2004). Although, construction organisations like all other organisations in other industries operate in a business environment that comperes high competitive intensity, but the mainstream strategic management research have not characteristically focused the industry, and also the conservative philosophy within the construction industry has often tone down significance of strategy (Cheah and Garvin, 2004). Hence, competitive strategy helps in exploring how an organisation operates in order to improve its performance (Porter, 1980).

Based on the arguments of Porter (1980; 1985), Betts and Ofori (1992) investigate the use of strategic planning for gaining competitive advantage in construction and thus, conclude that Porter's concept of Strategic approaches are relevant and have appreciable use in construction. Fellow (1993) differs on this assertion; construction industry was viewed from the neoclassical economic perspectives which argue that there is need for demand factor in determining

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competitive strategy. Fellow (1993) highlights among other things the peculiar characteristics of construction industry such as fragmentation of the construction process as well as the difference in the objectives and competitive behaviour of stakeholders involved in the process which do prevent them from realising the achieved performance as against actual performance. However, in response to the argument, Betts and Ofori (1993) relate the supply and demand to strategic advantage and strategic targets respectively as the origin of generic strategies. Betts and Ofori (1993) therefore, conclude that since there is dearth of identified body of knowledge on the economics and management of construction, transference of research ideas from other field is plausible.

Building on this, many strategy researchers in construction management have explored the relevance of Porter's generic strategies in construction and how it influences organisational performance (Price, 2003; Kale and Arditi, 2003; Dikmen and Birgonul, 2003; Tan, Shen and Langston, 2012). Some of these studies focused on the link either between environment and organisational variables or between strategies and performance rather on the relationship among all the variables. This constitutes a gap in literature and thus, a balance between these contingent factors: characteristics of organisation, environmental factors and competitive strategy will assist organisations in achieving performance excellence. This study examines the impact of organisational contingency variables on performance of construction organisations in South Africa.

2.0 Hypotheses development

2.1 Organisational characteristics

Organisational characteristic can be viewed as the features emerging from both the management philosophy adopted by organisations through its structure or strategy, and from exemplified management culture within the organisation in terms of relationship with the stakeholders (Magnier-watanabe and Sino, 2008). It revolves around how effective and efficient an organisation is in achieving or in the pursuance of its overall objectives and goals. In fact, van Loveren (2007) asserts that the more efficient an organisation, the better it is at attaining organisational goals and creating a positive outlook in the eyes of its stakeholders. Mathisen and Einarsen (2004) explain that organisation's outlook is more essential to its internal stakeholders, because their perception of the organisation will exhibit significant impacts on their productivity, morale and on the realisation of organisation overall goals. Organisations deal with complex and large amount of resources that requires strategic decisions in their deployment to achieve organisational goals (Amason, 1996).

Decision-making on how to run an organisation may likely be made under unpredictable conditions most especially the non-repetitive type (Elbanna, Child & Dayan, 2013). Therefore, there is need for managers to critically evaluate most efficient and effective approach to adopt in ensuring that stakeholders are carried along. This requires a frantic efforts and very challenging especially in construction where people with diverging objectives are brought together on *ad hoc*

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basis. However, previous studies have identified organisational structure, style of leadership, decision-making process as well as relationship with employees to have significant impact on organisation's efficiency (Potosky and Ramakrishna, 2002; Amzat and Idris, 2012). Effectiveness and efficiency of an organisation is contingent upon some factors, this study thus considers organisational characteristics from tripod stand of decision-making style, management style and organisational structure.

The contingent links between structure and competitive strategy, and their influence on organisation performance has be researched using contingency theory (Pertusa-Ortega, Molina-Azorin and Claver-Cortes, 2010).However, Pertusa-Ortega et al. (2010) asserts that indirect relationship exists between organisational structure and performance, but influences performance through strategy. Gupta and Govindarajan's (1984) contends that managerial decision-making style moderates the strength of relationship between strategy and organisational performance, while Limsila and Ogunlana (2008) assert that when project managers adapt their style of management in a way that creates positive working environment, it leads to enhance organisational commitment, and improve work performance. There dearth of empirical research to validate the relationship in construction, therefore this study intends to bridge the gap in literature by hypothesising that:

H1: Organisational characteristics is significantly related to competitive strategy

H2: Organisational characteristics is significantly related to organisational performance

2.2 Environment, strategy and performance

Porter (1980) posits that the essence of formulating strategy is to relate organisations to its environment. Since then, the relationship between strategy and environment as well as their resultant impacts on organisational performance has been empirically examined (Kabadayi, Eyuboglu & Thomas, 2007; Nandakumar, O'Regan and Ghobadian, 2010). Some of these empirical studies acknowledged that different generic strategies are suitable for different environments and that relationship exists between competitive strategy and organisational performance (e.g. Kabadayi et al., 2007). For example, Keat and Hitts (1988) establish that in a stable or less hostile environment cost-leadership strategy offer most advantage for organisations to achieve superior performance, whereas differentiation strategy is appropriate for uncertain and dynamic environments (Porter, 1980; Kabadayi et al., 2007; Nandakumar et al., 2010). This was further explained by Miller (1991), Ward, Bickford and Leong (1996), that in a hostile business environment organisation is required to put more emphasis on efficiency that can lead to cost lowering rather differentiating its product or services. Cost-leadership organisations look for opportunities in the environment using their strengths while organisations that pursue differentiation strategy examines or x-rays the environment for likely threat to their business (Jennings and Lumpkin, 1992). However, Nandakumar et al. (2010) argue that many of previous empirical studies finding on the influence of environment on the strength of relationship between strategy and performance have been equivocally reported. Some of these studies are conducted with the mainstream of strategic management, there is little or no

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empirical research in construction that explores this area, and as a result, therefore, this study identifies this as a gap research. To investigate this gap, hypotheses was put forward that:

H3: There is no significant relationship between environment and organisational performance

H4: Environment moderates the relationship between strategy and organisational performance

2.3 Competitive strategies and organisational performance

A plethora attempts have been made by various strategy researchers to demonstrate the significance of the generic strategies both in construction management research and main stream of strategic management studies (Dess and Davis, 1984; Kale and Arditi, 2003, Ling, Lbs and Cuervo, 2005; Tan et al., 2012; Budayan, Dikmen and Birgonul, 2013). Some of the efforts made by previous studies include identifying the nature of relationship between competitive strategy and performance, and the need to establish performance measures that relates to strategy adopted by organisations (Govindarajan and Gupta, 1995; Jusoh and Parnell, 2008). Evidence exists in literature that all the competitive strategies have different impact on Organisational performance, but the result is inconclusive (Jusoh and Parnell, 2008; Allen and Helm, 2006). Some studies have, however, argue that there is no relationship between strategy and performance (e.g. McGee and Thomas, 1992), while others have found that relationship exists between strategy and performance (Nandakumar, et al., 2010; Lechner and Gudmundson, 2012; Teeratansirikool, Siengthai, Badir and Charoenngam, 2013).

Nonetheless, in construction organisations pursue default strategy- cost leadership due to the traditional procurement practices of lowest responsive tenderer (Price, 2003). Oz (2001) affirms this in the Turkish construction industry; however, Dikmen and Birgonul (2003) added that both differentiation and cost leadership are being practice in Turkish construction industry. The extant literature in construction management research supports that generic strategies lead to superior performance. Although, some researchers view that differentiation strategy lead to a better performance (Kale and Arditi, 2003; Budayan et al., 2013), while some argue that selection of strategies to achieve improved performance should be organisations objectives and the prevalent competitive behaviour in the market which may require cost advantage or differentiation (Dikmen and Birgonul, 2003; Tan et al., 2012). Richard, *et al.* (2009) suggest the need for a researcher to select appropriate measures of performance that are closely linked to the research question under investigation and assert a comprehensive measure of performance that will take into consideration the divergence between measures and their multidimensionality. This study defines organisational performance as the level of a firm's achievement on both subjective and quasi-objective indicators. The fully subjective is the objective achievement while the quasi-objective measures used in this study are tagged competitive analysis, it obtain specific objective information about performance using self-report

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methods, for example, asking manager to estimate the market share of the organisation, return on assets, profit margin etc.This study thus hypothesised that:

H5: There is a significant relationship between competitive strategy and organisational performance

3.0 Methodology

This research examines the impact of organisational characteristics and competitive strategy on organisational performance with respect the moderating role of business environment with a focus on large construction organisations both civil and building in the South African construction industry. The study conducted a pilot survey among 30 construction organisations which was randomly selected before the data collection to improve reliability and ensure the clearness of the questionnaires. A total of 277 questionnaires were sent out to Chief Executives Officers (CEO), directors and senior management within the target population. The selection of the sample size was based on non-response bias using a calculation of minimum sample size technique (Ankrah, 2007) in which 277 organisations out of 577 registered construction organisations in grades 7, 8 and 9 on the cidb registers of contractors in three major province of Gauteng, Kwazulu Natal and the Western Cape. This province represent where almost 70% of public projects are being executed in the last six years (SatSA, 2012). The questionnaire was administered via email using web-approach to questionnaire administration to the CEO of each organisation, the person who is has the complete knowledge of the organisation's strategy. Of the 277 questionnaires sent out, 72 (26%) valid and usable responses were obtained. The paper presents part of an on-going PhD research that is at discussion stage. This paper considers the three generic strategy as classified by Porter (1980; 1985) and the measurement scales were adapted from Kale and Arditi (2003). This study measures the performance of organisations using both subjective and quasi-objective measures; these were adapted from (Dess & Davis, 1984; Nandakumar et al., 2010). Organisational characteristics was operationalised using decision-making style, management style and organisational structure (Lansley, 1987; Amzat & Idris, 2012), while business environment dimensions were measured using previously validated scales (Kabadayi, et al., 2007; Nandakumar et al., 2010). Each variable in the constructs were measured reflectively with multi-item five-point Likert scales.

4.0 Findings

This section of the paper presents the findings of the study. In order to evaluate the developed research model shown in Figure 1, SmartPLS (Version 2.0 M3) was used to analyse the quantitative data collected. SmartPLS software was selected because of its special feature in dealing with unobserved heterogeneity through the finite mixture routine (FIMIX) technique (Ringle, Wende, & Will 2010; Sarstedt & Ringle 2010; Sarstedt, Becker & Schwaiger 2011). The default total of 200 re-samples were employed to produce the test of significant (t- statistics), descriptive statistics as well as the standard error of the estimate. PLS-SEM is employed in this

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study because it relaxes the demand for distributional assumptions; its capability in producing unbiased estimates of parameters with small data set which may fall short of conditions for modelling with Amos or Lisrel (Hair *et al*., 2012; Robins, 2012); it accommodates easily the formative indicators in measurement models which other techniques may not allow (Robins, 2012); and finally, it is considered to be the most suitable methods for the development of new theory (Elbanna et al., 2013). The study first examines the reliability and internal consistency of the measurement items in the study as shown in Table 1. The Cronbach's Alpha values were above the acceptable threshold of 0.5; this indicates that the items are reliable in measuring the constructs in the model. Next, the study examined the convergent validity of the items to determine the extent to which multiple items to measure the same construct are in accord. The study then assesses the discriminant validity by comparing the squared correlations between the variance extracted and constructs for each of the constructs (Fornell & Larcker, 1981).

Table 1: Showing the Cronbach's Alpha reliability of the measures

Constructs	Measurement item	Alpha Value
organisational characteristics	1. Management style	0.750
	2. Decision-making style	0.580
Competitive strategies	1. Differentiation	0.940
	2. Cost-leadership	0.775
Dimensions of the Environment	1. Dynamism	0.562
	2. Complexity	0.554
Organisational Performance	1. Objective achievement	0.834
	2. Competitive analysis	0.784

4.1 Evaluation of the Measurement Model

The study evaluate the quality of the model by examining the individual measurement item and the reliability of the scale used as well as the discriminant and convergent reliability of the model constructs. To test these properties, confirmatory factor analysis (CFA) was conducted by using PLS algorithm to evaluate convergent validity, reliability, and discriminant validity of the measurement scales. Tables 2, 3 and 4 show the item loadings, discriminant validity and composite reliability. As shown in table 3, most item loadings were larger than 0.7 and significant at 0.01 except management style which was below the threshold of 0.5 (Field, 2013) but retained because of its significant contribution to constructs based on t-values (Bagozzi, Yi, & Philipps, 1991; Gefen, Straub, & Boudreau, 2000; Akter, D'Ambra & Ray, 2010). However, Chu et al. (2004) suggest that items with small loading and insignificant contributions should be dropped; on this basis some measurement items that show low loadings and insignificant contribution to the construct they measure were dropped. In order to test the convergent validity, all the composite reliability (CR) values were above .70 (Chin, 2010; Akter, D'Ambra & Ray, 2010; Chin, Lo & Ramayah, 2013) and the average variance extracted (AVE) values meet the minimum criteria of .50 (Henseler, Ringle, & Sinkovics, 2009).

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Table 2: Outer model loadings and cross loadings for measurement (outer) model

Measurement item	Environment	Org. Xtic	PERFORMANCE	STRATEGY
Dynamism	**0.5578**	-0.1371	0.0193	0.1695
Complexity	**0.8861**	0.0300	0.0981	0.2852
Decision-making style	-0.1200	**0.8959**	0.3908	0.1097
Management style	0.1492	**0.4817**	0.1776	0.1145
Objective achievement	0.1782	0.2009	**0.7090**	0.3626
Competitive analysis	-0.0535	0.3924	**0.6921**	0.0744
Differentiation strategy	0.3578	0.0996	0.1893	**0.8260**
Cost-leadership strategy	0.1099	0.1329	0.3125	**0.7190**

Table 3: Result of outer loading of the model

Model Path	Original Sample loading	Sample Mean (M)	Standard Deviation	Standard Error	T Statistics
COMPAN <- PERFORMANCE	0.6921	0.6687	0.2999	0.2999	2.3079
COST <- STRATEGY	0.7190	0.6634	0.2540	0.2540	2.8309
CPL <- Environment	0.8861	0.8084	0.2011	0.2011	4.4055
DIFF <- STRATEGY	0.8260	0.7932	0.1748	0.1748	4.7256
DMS <- Org. Xtic	0.8959	0.8649	0.1358	0.1358	6.5971
DMY <- Environment	0.5578	0.5065	0.3672	0.3672	1.5193
MGS <- Org. Xtic	0.4817	0.4684	0.2441	0.2441	1.9734
OBJACH <- PERFORMANCE	0.7090	0.6211	0.2740	0.2740	2.5874

In Table 3, all the t-values except dynamism and environment exceeded 1.96 significant levels which depict statistical significance at .05 levels of confidence, it can thus be concluded that all the measurements items were significant in explaining the research construct they measure. In PLS analysis, Chin (2010) highlights two criteria to be used in assessing discriminant validity: items should load more strongly on their corresponding construct than on other constructs; and second, the square root of each reflective construct's AVE should be greater than the level of correlations involving the construct. The results of the discriminant validity is presented in Table 4, all Composite Reliability (CRs) and Average Variance Extracted (AVEs), exceeded the threshold values of 0.7 and 0.5, respectively (Akter, D'Ambra & Ray, 2010; Chin, Lo & Ramayah, 2013). Performance has lowest AVE (0.5909) and CR (0.7585); however, all those values exceeded their recommended threshold values for both properties and it can therefore

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be said that the measurement model was satisfactory and offered enough confirmation in terms of reliability, convergent validity, and discriminant validity of the measurement scales.

Table 4: Discriminant Validity of Constructs

	AVE	Composite Reliability	Envi.	Org. Xtic	Perf.	Strategy
Environment	0.6482	0.7976	1.0000			
Organisational Characteristics	0.6173	0.7628	-0.0389	1.0000		
Performance	0.5909	0.7585	0.0909	0.4218	1.0000	
Strategy	0.6996	0.8488	0.3172	0.1472	0.3142	1.0000

4.2 Evaluation of the Structural Model

The quality of PLS-SEM model can be evaluated using two indicators: the variance explained (R^2) in the endogenous variables and the regression coefficients' significance (Saade, 2007; Chin, 2010). The R^2 values showed in Figure 1 (0.126 and 0.244) are higher than the validated 10% (Falk and Miller, 1992), this depicts that the model testing showed that our model results in acceptable. Figure 2 and Tables 5 and 6 present the findings of the tested hypotheses. A path is significant iif the resultant empirical t-value is above 1.96 (p = 0.05); when the critical t-values is above 2.58, (p =0.01); and when it is above 1.64, (p = 0.10).The findings indicated organisational characteristics is significantly and directly related to organisational performance at 0.01 level of confidence. The relationship between environment and strategy was also found to be significant at 0.01 level, while strategy is positively and significantly linked to organisational performance at 0.1 level of confidence. The relationship between organisational characteristic was found to be insignificant while the results indicate that environment moderates the strength of association between strategy and performance as insignificant link was shown between environment and performance. Hypotheses H2, H3, H4 and H5 were accepted, while, H1 was rejected.

Table 5: PLS Path modelling results with path coefficients

Model Paths	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	Standard Error	T Statistics
Environment -> PERFORMANCE	0.0270	0.0272	0.1091	0.1091	0.2475
Environment -> STRATEGY	0.3234	0.3217	0.1133	0.1133	2.8537
Org. Xtic -> PERFORMANCE	0.3862	0.3883	0.1149	0.1149	3.3619
Org. Xtic -> STRATEGY	0.1597	0.1644	0.1173	0.1173	1.3615
STRATEGY -> PERFORMANCE	0.2488	0.2339	0.1481	0.1481	1.6800

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Table 6: Path Coefficients and Hypothesis Testing

Hypothesis	Relationship	Coefficient	t-statistics	Supported
H1	Organisational characteristics is significantly related to competitive strategies	0.0270	0.2475	Not supported
H2	Organisational characteristics is significantly related to organisational performance	0.3234	2.8537	Supported
H3	Environment is significantly related competitive strategies	0.3862	3.3619	Supported
H4	Environment is insignificantly related organisational performance	0.1597	1.3615	supported
H5	There is a significant relationship between competitive strategy and organisational performance	0.2488	1.6800	Supported

To examine the global validation of the model, the study employs a global criterion of goodness of fit (GoF index) suggested by (Tenenhaus Vinzi, Chatelin & Lauro, 2005). GoF index which is described as the geometric mean of the *average communality* index and the average R^2 value (Tenenhaus *et al*., 2005). This study follow the procedural guidelines provided by Wetzels, Schroder and Oppen (2009), and computed the GoF values, which may be considered as minimum values for global validation of PLS path models. The GoF was calculated using the equation given below, the average R^2 is 0.185 from figure 1 and the average of all the variance explained from Table 4 is 0.639, hence the calculated GoF value is 0.34 this falls in between the medium and large value given by the rule of thumb, the standard values given by Akter, D'Ambra and Ray (2011) indicates the following: (*GoFsmall* =0.1, *GoFmedium* =0.25, *GoFlarge* =0.36). The study thus conclude that the partial model in this research has above average predictive power and that it also offers average support to global validation of the PLS model (Wetzels *et al*., 2009).

GoF = $\sqrt{Average R^2 X\ Average\ (AVE)}$…… (i)

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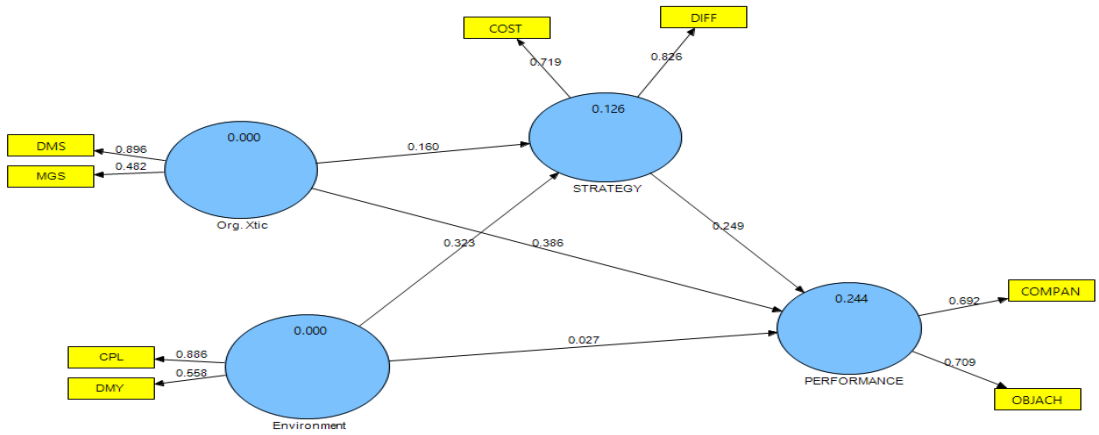

Figure 1: A developed model showing result of the path analysis

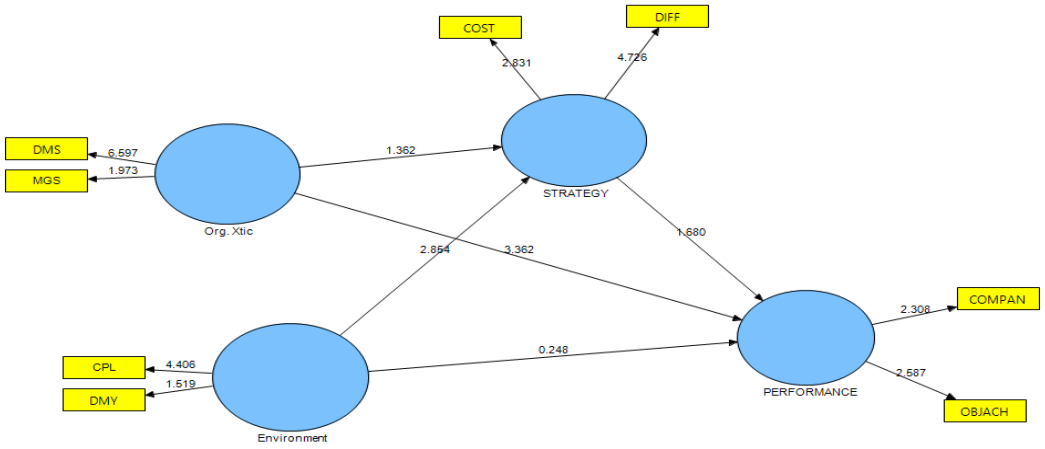

Figure 2: Research model showing the t-values

5.0 Discussion of findings from the models results

From the results of the models explained in the sections above, the structural models tested indicate that business environment dimension as well as organisational characteristic influences competitive strategies employed by organisations in achieving superior performance with R^2

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values of 12.6% which is higher than the acceptable 10% reported by Elbanna *et al*. (2013). However, the relationship between organisational characteristics and competitive strategy is insignificant but positively related, whereas environment is significantly related to competitive strategy this imply that environment and organisational characteristics jointly explained 12.6% of the variations of competitive strategies in achieving organisations goals. Organisational characteristic, exhibit direct and positive significant relationship with organisational with 1% level of significance. Considering the reflective indicators that contributed to the significance level, a viable decision-making style combine with effective management philosophy will lead to a better performance as summarised by the model (r (path) = 0.896; t = 6.597). Organisational characteristics (decision-making and management style) is positive but not significantly related to strategy (Path = 0.160; t = 1.362). This result relates well with Gupta and Govindarajan's (1984) finding that strategy variables such as decision-making style moderates the strength of relationship between strategy and organisational performance.

The models result supported the hypothesis that environment moderates the strength of relationship between strategy and performance as insignificant relationship is shown by the model. This consistent with the findings of previous studies that established that environment play a mediating role in the strength of relationship between strategy and performance (Goll and Rasheed, 1997; Kabadayi *et al*., 2007; Nandakumar et al., 2010), Competitive strategy is positively and significantly related to organisational performance (path = 0.249; t = 1.68) with the R^2 values 24.4%. The model result is validates by the assertion of Nandakumar et al. (2010) that to enhance organisational performance both differentiation and cost leadership are efficient in environment that is dynamic or complex. In summary, the results upheld the hypothesised statement that combinations of the three construct (organisational characteristics, strategy and environment) will lead to a superior performance. The critical link between strategy and performance has the coefficient (0.249) for the PLS-SEM path model estimated on aggregate effect level. Table 6 provides the summary of effects on hypotheses.

6.0 Conclusion and implications

This study examines the relationship between organisational characteristics, competitive strategies and organisational performance as well as the moderating role of business environments. The research upholds four of the hypothesised statements and therefore concludes that significant relationship exists between organisational characteristic and performance; between environment and strategy; between strategy and performance. It also reaffirm that environment moderates the strength of relationship between strategy and performance. However, this study presents some hypothetical and practical implications for researchers and industry practitioners. First, the research provides a basis for future studies in construction management field to further investigate the use of business environment as a moderator as well as influence of organisational characteristics, strategies on performance using larger sample size.in other industries. Second, the results of this research can provide invaluable information to construction organisations managers, project managers as well as

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CEOs to understand the impact of their decisions and management philosophy on the organisations performance.

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ELECTRONIC PROCUREMENT IN THE SOUTH AFRICAN CONSTRUCTION SECTOR: CASE STUDY OF GOVERNMENT DEPARTMENTS IN THE GAUTENG PROVINCE

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Abstract

Electronic procurement is a valuable means through which organisations can promote accountability, efficiency, transparency and value for money in the acquisition of goods, services, utilities and works. The adoption and use of electronic procurement in the South African construction industry is still in its early stages particularly in the public sector. The research aim was to ascertain construction procurement practices; and the extent of e-procurement use in the Gauteng Province of South Africa. Qualitative data collected through interviews with seven respondents in two government departments was transcribed and then analysed using content analysis. The findings indicate that the paper-based system is prone to manipulations, delays in approval, poor records keeping and wasted resources. A limited use of electronic systems in the procurement of works was observed, with the call for tenders and payment of contractors being the two main activities executed using electronic database and software respectively. No evidence of electronic tendering was found. The principal reasons for the limited use of electronic procurement systems were attributed to (1) lack of a definite government policy to implement e-procurement; (2) reliability of ICT infrastructure; (3) high costs of installing and operating e-procurement systems; and (4) perceived negative impact of e-procurement adoption on smaller firms and employment of people in the departments. Given the benefits and increasing use of e-procurement globally, these findings should be addressed to maximise the diffusion and adoption of e-procurement in government departments

Keywords: construction procurement, e-procurement, government department, interview, South Africa

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2.0 Introduction

Since the introduction of web service aspect of the internet in the mid-1990s, there has been increasing use of electronic procurement to support the execution of procurement activities in the different sectors, including construction. In this paper, electronic procurement (e-procurement) refers to the use of electronic communications and transaction processes to buy supplies and services or conduct tendering for works as defined by Bausa *et al*. (2013:5) in the e-procurement golden book. This means that e-procurement in construction entails the use of electronic communication to notify or inform stakeholders about tender opportunities, exchange construction project information and data, conduct tendering for works, evaluate tenders, award and administer contracts.

In the 1960s, electronic systems such as the electronic data interchange (EDI) was used to support the exchange of construction project information as explained by Gibson and Bell (1990) in their paper on electronic data interchange in construction. Since then, the use of electronic systems has developed to the current state where internet-supported technologies and applications serve as platforms for conducting procurement activities as explained in the United Nation procurement practitioner's handbook (UN, 2006). In a review of developments in electronic commerce as applied to construction, Anumba and Ruikar (2002) noted that the use of electronic means to support the execution of construction activities is a response to the need to improve the traditional business process in construction and the sector's level of productivity and competitiveness. In fact, current development shows that the existing e-procurement systems help to address challenges associated with paper-based system in data management (e.g. capturing, storage, processing, retrieval), real time interactions and exchange of project information and data among geographically dispersed participants in the entire construction procurement lifecycle as the following authors: (i) Mohammed (2003) in a study of web-based technology in support of construction supply chain management (ii) Eadie *et al*.(2007) in a study on drivers and barriers to Public Sector e-procurement within Northern Ireland's construction industry; and (iii) Eadie *et al*. (2011) in analysis of the use of e-procurement in the public and private sectors of the UK construction industry help to buttress.

In the context of South Africa, there is a dearth of published works on the use of electronic systems to support procurement activities, especially in the construction sector. Among the very few works identified are: (i) Coetzee and Boshoff, (1998), which examined the use of e-Commerce in the procurement of construction materials (ii) Jooste and Van Schoor, (2003) that explored a framework for the implementation of e-procurement in the different industrial sectors; and (iii) empirical study on the implementation of regulated-based e-procurement in the Eastern Cape provincial administration by Van Greunen *et al*. (2010). These authors are in agreement that there are challenges in the current procurement practices and barriers to the uptake of e-procurement systems and applications in addressing the challenges in the country.

To promote accountability, efficiency, transparency and value for money in the procurement of public works and infrastructure, there is a need to investigate and understand the extent to which government departments in South Africa are using e-procurement systems to support the execution of construction procurement activities. Therefore, this study was designed to investigate current procurement practices and the use of e-procurement in the South African construction sector using two government departments responsible for infrastructure development and public works in the of Gauteng Province as case study. The specific research questions the study sought to address are:

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- What are the challenges associated with the current construction procurement practices in government departments in the Gauteng province of South Africa?
- To what extent are e-procurement systems used to address these challenges? And
- What are the barriers to the adoption of e-procurement in the two government departments investigated?

This study hopes to bridge some gaps in the literature and makes contribution to the current discourse on the use of e-procurement in the South African construction sector from the perspective of government departments.

2.0 LITERATURE REVIEW

The review of literature is focused on three key areas that are related to the objectives of the research. These are electronic procurement in construction; benefits and barriers of e-procurement in construction.

Broadly speaking, construction procurement encompass all activities involved in the creation, management and fulfilment of contracts relating to the provision of goods, services, engineering and construction works or disposal, or any combination thereof as defined in the International Standard Organization document on construction procurement (ISO 10845, 2010). The specific activities involved are related to announcement /notification or informing stakeholders about tender opportunities (soliciting for tender offers); exchange of project information and data among participants; tendering; evaluation of tenders, award and management of construction contracts (see Bausa et al., 2013).

Prior to the advent of electronic systems, the execution of construction procurement activities had traditionally relied on paper-based processes. However, these have overtime proven to be inefficient in dealing with the demands and complexities of contemporary procurement activities. This is because the paper-based processes are slow, time consuming, labour intensive, attract high transaction and operational costs, associated with poor data management (capturing, storage, retrieval, reproduction and transmission) and result in unnecessary liability claims and low productivity as the following studies (i) evaluation and improvement of the procurement process in construction projects by Alarcon *et al.* (1999) (ii) the role of electronic procurement and Global Sourcing techniques in the United Kingdom construction industry by McIntosh and Sloan (2001); and (ii) Mohammed (2003) help to explain. Hence, in a review of past, present and future of web-based project management and collaboration tools and their adoption by the US AEC industry, Becerik (2004) noted that the use of electronic systems to support the execution of construction procurement activities seeks to improve communication and collaboration as well as promote accurate, efficient and timely exchange of project data and information among the different participants.

The review of literature reveals that there is a wide range of electronic systems and applications currently used to support the execution of construction procurement activities. These include web-enabled software packages such as BIM technology used in the production of construction drawings, specifications and bill of quantities (Jardim-Gonclaves, 2011; Nawari, 2012; Bynum et al., 2013), network technologies such as EDI, e-mail, wireless technologies, e-Marketplace and Web 2.0 for the exchange of project data and information (Bertot et al., 2010; El-Ghazali et al., 2012; Shalle et al., 2013), data collection and handling technologies (e.g. GIS, GPS, RFID) (Underwood and Isikdag, 2011; El-Ghazali et al., 2012; Yassine et al., 2012) and integrative and collaboration technologies such BIM, cloud computing, customised e-procurement and project

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management software applications, which facilitate the integration of several procurement activities (Zuo and Seo, 2006; Teo et al., 2009; Fathi et al.,2012). One vital feature of these electronic systems and applications is that they facilitate better data management (e.g. capturing, storage, processing, and retrieval), real time interactions and exchange of project information and data among geographically dispersed and multidisciplinary participants in the entire construction procurement lifecycle, which are not possible with the paper-based system. Hence, these systems are currently used as platforms for conducting construction procurement activities globally.

Further, the literature is replete with studies on the benefits and barriers of e-procurement in the different industrial sectors. Mohamed (2003) views the benefits of e-procurement from three main perspectives: (i) as a communication channel for organizing and communicating information, and improving interactivity among project participants (ii) as a transaction channel for streamlining transaction process, thereby reducing the complexity of task, paperwork and transaction cost; and (iii) as a distribution channel for reducing delivery and operating cost and time. Yu *et al*. (2008) noted that e-procurement promotes transparency in the procurement process; and thus Bertot *et al*. (2010) made it clear that the adoption of e-procurement in the public sector has been driven primarily by the need to entrench accountability and transparency into the procurement process as explained in their study on using ICTs to create a culture of transparency. Despite these benefits, there is copious evidence in the literature that there are several barriers to the adoption of e-procurement in the different countries as studies on e-procurement implementations in Italy, New South Wales, New Zealand, Scotland and Western Australia by the Australian Government Information Office (2005) and that on five major e-procurement projects in UK-based public sector agencies by Doherty et al. (2013) help to substantiate.

In a study on the drivers and barriers for e-procurement in the construction industry in Northern Island, Eadie *et al*. (2007) pointed out that construction procurement is more complex than general procurement. According to them, this is because firstly, different parties such as clients, consultants, contractors and suppliers are involved in the process. Secondly, construction work specifications characterised by some elements of uncertainty leading to greater complexity as products and production lines may change locations in the process (see also Jardim-Gonclaves, 2011). On this account, the study on the reasons for the uptake of e-procurement in construction in 29 construction firms in the UK by Eadie *et al.* (2010) reveals that the barriers to e-procurement in the construction sector can be classified into cultural, compatibility, infrastructure, legal security and personnel. Table 1 is a summary of the benefits and barriers of e-procurement in construction sector as identified in the literature. From Table 1, it is evident that the benefits of e-procurement in construction are enormous and related to improving the efficiency and effectiveness of construction procurement process in terms of cost, time and quality. On the other hand, the key barriers to the adoption of e-procurement in the public sector are generally related to cultural, environmental, technology, organizational, and social factors.

Table 1: Benefits and barriers of e-procurement in construction

Benefits	Description	References
Cost	Minimization of the costs of printing and transmitting drawings; timely delivery of information; ensures transparency in procurement process; enhances opportunity for future collaboration process, transaction and administration costs saving; service/material / product costs savings; increase in profit margin; strategic cost saving	Mohamed, (2003); Zuo and Seo (2006); Eadie et al (2010)

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Continued Table 1: Benefits and barriers of e-procurement in construction

Time	Timely delivery of information, speed of work shorter overall procurement cycle, faster communication cycle time; reduction in time through greater transparency	Mohamed, (2003); Zuo and Seo (2006); Egbu *et al*. (2003); Eadie et al (2010)
Quality	increase in the quality of documents, improve quality through increased competition, benchmarking, visibility in the supply chain, efficiency; improved communication; increased accuracy by eliminating errors through the use of computers; quick and easy access to information	Egbu *et al*. (2003); Zuo and Seo (2006); Eadie et al (2010)
General	Enhanced inventory management; convenience of archiving of completed works; develops technical skills, knowledge and expertise of procurement staff; better integration of design and construction; improve flexibility to changing needs; access to better work opportunity.	Zuo and Seo (2006); Eadie et al (2010)
Barriers		
Cultural	Lack of leadership support ; resistance to change; bureaucratic dysfunctionalities; insufficient assessment of systems prior to installation; different national approaches to e-procurement; reluctance to buy-into one off system; perception of no business benefit realized; lack of publicity/ awareness of best practice solutions ,forum to exchange ideas and business relationship with suppliers providing e-procurement; organizational culture; lack of confidence in the new technology	Rankin *et al*., (2006); Eadie *et al*. (2007); Eadie et al. (2010)
Infrastructure	Lack of widely accepted e-procurement software solution, complicated procedures; poor access to Internet and ICT infrastructure; data transmission reassembly-incorrect ; partial display of data; clarity of sender and tender information	Egbu *et al*. (2003) Eadie *et al*. (2010)
Security	Security of data; confidentiality of information; tampering of data ; proof intent- electronic signatures	Aranda-Mena (2004) ; Rankin, et al. (2006); Eadie et al. (2007
Legal	Lack of national IT policy relating to e-procurement issues; lack of pertinent case law; enforceability of electronic contracts; level of legality of e-procurement	Aranda-Mena (2004), Eadie et al. (2007
Compatibility	Lack of flexibility in the use of e-procurement systems; interoperability of e-procurement software and systems; investment in compatible systems	Egbu et al.(2003) Rankin, et al, (2006); Eadie et al. (2007)
Personnel	Lack of technical expertise and staff turnover;	Aranda-Mena (2004) Eadie et al. (2007);
Economic	Other competing initiatives; information technology investment costs	Eadie et al. (2007)

3.0 RESEARCH DESIGN AND METHODS

As noted earlier, the goal of the study was to investigate the use of e-procurement in construction by two government departments in Gauteng Province of South Africa. In order to achieve this goal, it was important to choose appropriate research design. Among the various research strategies and approaches available, interview was used because it was considered the most suitable in addressing the broad aim and research questions of the current study.

Government departments were purposively chosen for this study because of the believe that the public sector should spearhead the adoption of e-procurement in construction to ensure accountability, efficiency, transparency and value for money in public procurement as Neupane

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et al. (2012) suggested. The Gauteng Province of South Africa was also chosen for the study for obvious reasons of being the most populated with approximately 12.7 million people, representing around 24 percent of South Africa's estimated population of 52.89 million (Statistics South Africa, 2014), and having strategic cities of Johannesburg and Pretoria-the administrative capital of South Africa. These suggest that this province has the largest economy in the country; hence large volume of construction procurement activities are most likely to place here in response to its demographic and economic status in South Africa in particular and the continent in as a whole .

Two departments responsible for physical infrastructure development and public works were purposely selected for investigation. Specifically, the supply chain management units of the two departments responsible for planning, executing and overseeing all construction procurement activities of the provincial administration were the target units. Interview guide containing questions on the challenges of current construction procurement

Practices; the extent of use of electronic systems to address these challenges and the barriers to the use of electronic systems in construction procurement in the Province was used to elicit responses from informants. This instrument was designed based on findings from the review of literature and interactions with experts in the field.

4.0 DATA COLLECTION AND ANALYSIS

The study was conducted in May 2013 in the study area. The target population was staff members actually involved in the planning and execution of construction procurement activities in the two departments. The human resource units of the departments assisted in identifying this category of staff members. Of the eight persons identified in the two departments, one person refused to participate in the research for personal reasons. Consequently, seven officers were interviewed using pre-determined questions drawn from the interview guide. The interviews took place in each of the interviewees' offices. Each interview session lasted approximately 30 minutes, and was audio recorded. All the seven interview sessions were completed in three days.

In view of the fact that data collected were mainly qualitative in nature data, content analysis was used in analysing the data. Initially, the data were transcribed, this was followed by the integration of related pieces information and idea from the different interviews; and identification of common and key themes emerging from all the interviews. Although attempt was made at improving the validity of the result of the research by ensuring that only top management staff members within the supply chain management unit in the two departments were selected to the study, the findings cannot be generalised for all the nine Provinces in South Africa.

5.0 RESULTS

Table 2 provides a summary of interview responses obtained from the seven respondents. It seems evident from Table 2 that there are a number of key challenges in the current construction procurement practices in the two departments investigated.

5.1 CHALLENGES OF CURRENT CONSTRUCTION PROCUREMENT PRACTICES

Among the challenges associated with current construction procurement practices in the two government departments identified by our informants is tampering, misplacement or loss of

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project information or data (e.g. tender submissions). Responding to the question on the problems of the current construction procurement practices, one of the respondents noted, "*the traditional way of doing things leaves you vulnerable to the tampering of documents",* while another explained that "*I can make examples on tender… yah… they are close to my area …let's say the tender closes today the tenders are recorded and kept in a safe office where not everyone can access it. But you will find that some people are able to access those documents even if they are not allowed to be on it. At times these documents are tampered with or misplaced".* In addition, the current practices were also identified to be characterised by poor recording keeping, duplication of efforts, delays in approval due to large volume of tender submissions and extensive paper work.

Table 2: Summary of interview responses

Discussion variables	Extracts from transcript of interviews with respondents						
	R1	R2	R3	R4	R5	R6	R7
Level of respondent's understanding of electronic procurement	Low	Low	Low	Medium	Low	Medium	High
Government legislation complied with in procurement	Section 217 of the Constitution, PFMA	PFMA, constitution, PPPFA and the BBBEE act.	PPPFA, PFMA, Competition Act, CIDB guidelines	PFMA	Information Technology Act.	Constitution, PFMA, treasury regulation	CIDB regulations
Use of e-procurement in department	It has never been used. It's been manual since the day that I started.	I really don't know much about e-procurement	… in our department we have not implement it… less than 5% of activities are done electronically	I am aware of it, for instance when we advertise Bids on the CIDB website and on the government bulletin	We only use it in a manner of buying goods and services. We currently use mostly paper	There are wishes to implement it in the future but there are no set target dates	In terms of our SCM systems there's no software that is currently being utilized
Factors inhibiting adoption of e-procurement in government departments	Money, electronic infrastructure, requirement for documents to be in original not electronic form (e.g. tax clearance certificate)	ICT infrastructure (It's not yet advanced. Basically it's a well-functioning system but advance? No), possible impact on employment	ICT infrastructure (our server is not efficient in the sense that most of the time it's down)	ICT infrastructure, It's costly, and you will need to train people. Sometime you will have to downsize staff. Our logistics people are using e-procurement	ICT infrastructure, leadership and budget from Treasury Remember you will have to buy a server, licence and train the staff. And this licence you will have to pay over a certain period annually	Costly, leadership and budget from Treasury , ICT infrastructure , you need systems and when you procure that particular system you have to make sure that it run efficiently and to run the system it is costly	network stability, budget, resistance to change, a smooth transition

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Continued Table 2: Summary of interview responses

Current electronic systems used to support procurement	SCM system, use of CIDB portal for inviting tenders	GSSC, SAP	..they use it more in provisioning… stationary…they also use it in their orders processed electronically... when they communicate with the service providers	SAP, HRM or BAS... the software that is used in GSSC is called procure-to-pay system	SAP, GSSC - We are using it more on things that are below R 30 000.00 those above R 30 000.00 and less than R 500 000.00.	GSSC, database of Professional Service Providers (PSP) CIPC system to verify vendors, SARS system to verify tax clearances, CIDB database to verify grading of contractors	SAP system for the payment process of our suppliers
Procurement processes supported by electronic systems		Use of website to announce tenders. Payment – Here in our section its payment and provisions, acquisitions we are not.	We advertise on the tender bulletin	We advertise Bids on the CIDB website and on the government bulletin	We only use it in a manner of buying of goods and services. We use SAP, its used to order goods and payment	Award is published on the CIDB website, departmental portal, and our website as well, CIDB has an electronic database where you can source. Payment	
Problems currently experienced with paper-based system	Tampering with submission, accurate records keeping, duplication of effort, management of 150 tenders is a problem and requires many people	Loss of documents, tampering with documents	Tampering, misplacement of documents, delay in approvals processes sometimes because someone in not in the office, needs to be kept in safe place in office	Lot of paper usage. It is better if we use electronic mechanism because we can also have electronic files and signatures.	the current paper based method is easily manipulated	It is easy to manipulate this current system because it has a lot of gaps...anything that has a human element can be manipulated but e-procurement is programmed	Documents can be lost or misplaced, mixed up with other documents
Perceived impact and benefits of e-procurement	electronic procurement provides ease of tracking, security, potential impact on levels of employment	evidence is traceable	Efficiency, security (when you use electronic processes it is not easy for anyone to temper with the processes).	Save us from lot of papers used or wasted. Because it will also be addressing the issue of green agenda initiatives	In e-procurement you make a request electronically to the services providers. E-mechanism will receive, evaluate and give you reports. Unlike the current situation where we must evaluate and do all things	tracking system, auditing,, going to take up a few jobs done by a few individuals e-filing by SARS is an example of how to drive the change	economy efficiency and effectiveness, positive impact on smaller companies We need to adopt a strategic approach to it

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5.2. Extent of use of electronic procurement

Table 2 also shows that although four of the seven officers interviewed had low knowledge of e-procurement, it appears interesting that their responses on the perceived impact and benefits of e-procurement are consistent with evidence in the literature. In the words of one of the respondents *"I really don't know much about e-procurement but reading on the websites and searching doing research e-procurement is about procuring using a system…It's a system actually not just any internet*". The result also indicates that there is limited use of electronic systems to support the execution of construction procurement activities in the two departments. The following response provided by one of the interviewees help to buttress this:

"*I am aware of e-procurement but not in details because in our department we have not implemented it...We are pretty much into manual ... I would not called it electronic procurement the way it is currently done… all the processes are manual in the sense that everything we use paper work... I think less than 5% of our activities are done electronically"*

In addition, the data in Table 2 suggest that the current electronic systems used to support construction procurement are the Construction Industry Development Board (CIDB) portal, the Gauteng Shared Services Centre (GSSC) and SAP System Administrative Processes (SAP). According to those interviewed, the CIDB portal is a database of contractors and it is used for contractor selection and soliciting for tenders from contractors. In the words of a respondent: *"the electronic procurement that I am aware of is for instance when we advertise Bids on the CIDB website and on the government bulletin*…" The GSSC is an online procurement-to-pay system established by the government to support procurement process in the province, but it is currently not used in construction procurements, while SAP is used for requisition and data management, payment of contractors and suppliers. As one of the interviewees explained *"the SAP system that we are implementing has nothing to do with e-procurement. We are using SAP system to capture our information (data capturing) and pay our suppliers".*

5.3 Barriers to the use of electronic procurement

As regards the factors inhibiting the adoption of e-procurement in the departments, Table 2 also shows that the respondents were of the view that there was no definite government policy as regards the implementation e-procurement. For instance one of the respondents noted that *"National treasury is the one who is drawing up procurement policy.... We cannot implement electronic procurement without their approval".* Another respondent claimed that "*I have never heard any government principal talking about that unless I am not listening to the news correctly. I have never heard anyone talking about e-procurement more especially in government departments and governmental institutions*". Another barrier to e-procurement adoption identified was the cost of e-procurement technologies.

When asked on why they were not using e-procurement now, one of the officers responded: *"It's costly, and you will need to buy a server, licence and train the staff; and this licence you will have to pay over a certain period annually*". Another key barrier identified was a lack of very efficient and reliable ICT infrastructure to support the use of e-procurement. The following responses by two different respondents support this assertion, "*the ICT infrastructure of our department is not yet advanced. Basically it's a well-functioning system but not advance*"; and *"our network system it's not efficient, our telephone lines example... you find that the lines are not adequate... our server is not efficient in the sense that most of the time it's down. ...really I think we need to beef-up before we can adopt it"*. It is also seems evident from Table 2 that the fear that e-procurement adoption will result in for loss of jobs in the departments and have

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negative impact on smaller contractors was another barrier to the adoption of e-procurement. As one of the respondents noted: *"the adoption of e-procurement will have a negative effect on younger contractors, cause from my experience these upcoming contractors do not have the resources to buy equipment like fax, and emails, they run their businesses from their cell phones"*. Another respondent also opined that "*It will have a disastrous impact as most the contractors are used to a traditional method all over the country*".

6.0 DISCUSSION

From the result presented in the preceding section, three key issues have been identified and brought forward for discussion. These are the challenges of the current procurement practices; the extent to which electronic systems are used to support the execution of construction procurement activities; and the barriers to the use of e-procurement in construction in the two government departments investigated.

First, the study shows that current construction procurement practices in the departments are prone to manipulations, misplacement and loss of vital information, and characterised by poor recording keeping, duplication of efforts, delays in approvals due to large volume of documents and information involved and requires extensive paper work. This finding appears to be in support of the description of paper-based procurement process as described by Alarcon *et al*. (1999) and Mohammed (2003) as previously highlighted. It can be inferred from the result that the current construction procurement practices in the two departments are inefficient in data management (data capturing, storage, retrieval, reproduction and transmission) and involve wastage of resources. This goes to suggest that there is a need for the adoption of electronic systems to support and improve construction procurement practices in these government departments.

Second, it is also seems evident form the result that despite the availability of a wide range of electronic systems to support the execution of construction procurement activities, there is limited use of such systems in the two departments. In fact, the result reveals that that apart from the CIDB website and the SAP software used to advertise tenders and make payment to constructors, respectively, there are no other electronic systems identified in this study used by construction supply chain mangers in the two departments to support the execution of procurement activities. This finding corroborates that by Mutula and Mostert (2009) on the challenges and opportunities of e-Government implementation in South Africa, which found that there was a general underutilisation of ICTs in service delivery in the country; and also that by Van Greunen *et al*. (2010) indicating that there was also less adoption of information technology to support supply chain management in the Eastern Cape provincial government.

Lastly, as regards the barriers to the use of e-procurement in the departments, four key factors, namely, a lack of definite government policy on the adoption of e-procurement; the cost of acquisition, operating and maintenance of e-procurement systems, unreliable ICT infrastructure and perceived negative impacts on employment and small scale contractors were identified. Notably, the finding on a lack of clear government policy on e-procurement

Adoption is in line with finding by the Australian Government Information Office (2005) and Doherty *et al*. (2013) that a lack of public policy on e-Procurement was a barrier to the uptake of e-procurement in the different countries. Similarly, cost and infrastructure issues identified by the respondents are also consistent with the findings of previous studies (including Aranda-Mena, 2004; Rankin, et al., 2006; Eadie et al.,2007; Eadie et al., 2010) as previously

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highlighted. Further, the fear expressed by the respondents that e-procurement adoption can lead to loss of jobs and negative impacts on small scale contractors was to be expected given their knowledge base of e-procurement and the peculiar nature of the country, particularly with the preferential procurement policy (PPP), which seeks to provide employment and business opportunities to previously marginalized groups.

6. CONCLUSIONS AND RECOMMENDATIONS

This study examined and analysed the current procurement practices and the use of e-procurement in the South African construction sector using two government departments in Gauteng Province as case study. From findings of the study, the following conclusions can be made. First is that the current construction procurement practices in the two departments investigated appears not be promoting efficiency, transparency and value for money there are fraught with some challenges. Second is that there is limited use of e-procurement systems to support construction supply chain management in the departments. The last but not the least conclusion is that key barriers to the uptake of e-procurement in construction in government departments in the Gauteng province are cost, infrastructure and culturally related.

The study implies that in government departments in the Gauteng province of South Africa, the use of e-procurement systems in construction is relatively low when compared with the trend in the developed countries. Therefore to achieve better diffusion and maximize the benefits of e-procurement in construction in the South African public sector, the following recommendations are made.

First, there is a need for the government to come up with a definite policy on the adoption of e-procurement in its departments and agencies. This calls for policy guidelines and legislation by the appropriate government institution. As a change management strategy, an action plan need be developed that would see both the paper-based and electronic systems run concurrently for a period of time as the former is gradually phased out.

Second, the ICT infrastructure in government departments responsible for infrastructure development and public works need to be upgraded to ensure that they are reliable and can support smooth operation of e-procurement systems. Although this will require some financial investment, evidence in the literature indicates that the long term benefits and impact of e-procurement outweigh the financial investments on it.

Lastly, to cushion any negative effect the adoption of e-procurement in construction may have on small or emerging contractors, the CIDB and other relevant government agencies may have to provide technical support to this category of contractors in order to upgrade their IT facilities and skills; and develop capacities and capabilities to engage in e-procurement activities.

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INFORMATION AND COMMUNICATION TECHNOLOGY SUPPORTED INVENTORY MANAGEMENT: A TOOL FOR IMPROVING MATERIALS MANAGEMENT IN THE ZAMBIAN CONSTRUCTION INDUSTRY

Danstan Bwalya Chiponde[1], Chipozya Kosta Silungwe, Lawrence Mutale Wilfred M. Matipa and Sampa Chisumbe

Abstract

Efficient material inventory management is essential for project success. However, material inventory management is a challenge on many Zambian Construction sites, with many contractors relying on manual methods when it comes to materials management. The research therefore focused on the application of ICT inventory management to reduce costs. The research was conducted using both qualitative and quantitative approaches. To achieve this an appraisal through literature review was done to evaluate how the use of ICT in other countries aids in construction materials inventory management, through the use of bar coding and Radio Frequency Identification as the possible ICT systems and approaches available for use in improving construction materials inventory management on Zambian construction sites at reduced costs. Results obtained showed that there are many challenges associated with the current methods of materials management in the ZCI. The methods used are limited due to the fact that they are labour intensive and error-prone. This leads to material wastage and encourages excessive material procurement, schedule delays, decrease in productivity and contribute to the increase in construction costs ultimately. This research therefore established that barcode and radio frequency identification are suitable ICT tools needed to improve material inventory management as they lead to reduction in errors, construction costs, project delays, and enhance productivity. It is recommended that contractors implement ICT in the controlling of material resources through the use of bar-coding or RFID to facilitate effectiveness and efficiency in materials management.

Keywords: Inventory, Management, Zambian Construction, Technology

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1.0 INTRODUCTION

Cash flow has become crucial for the survival of any business, if materials are purchased early, capital may be tied up and interest charges incurred on the excess inventory. Material may deteriorate during storage or be stolen resulting in delays and extra expense if materials required for particular activities are not available (Donyavi and Flanagan, 2009). The use of Information and Communication Technology in material inventory management and monitoring has advanced and gained importance in recent years in most industries. However, this is not so with the construction industry (Chen and Wong, 2002). In Zambia for instance, many contractors rely on manual methods when it comes to material tracking, control and management which involve physical counting and verification of material deliveries and stock; location and identification on site; tracking, monitoring and control. Research conducted by Mutumwa (2005) on an effective management tool for monitoring material use on construction projects in the Zambian Construction Industry, revealed that there is a need for some form of accounting from contractors, if the management of materials is to be effective. He further noted that most contractors only carry out monthly material reconciliations instead of daily or weekly, implying that they lack a consistent system that can continuously monitor the materials.

Donyavi and Flanagan (2009) define material management as the system for planning and control to ensure that the right quality and quantity of materials and equipment are specified in a timely manner. Importantly materials represent 45-50% and 30 to 70% of the project construction costs for building and civil engineering projects, respectively (Donyavi and Flanagan, 2009). Furthermore, according to Che Wan Putra et al. (cited in Kasim et al.,2005) inappropriate handling and material management on construction sites has an effect on one or more of the three project constraints; namely time, cost and quality. Realising the unnecessary costs and delays arising from ineffective material management, the research aimed at exploring ICT supported material management systems.

1.1 Challenges of Inventory management

The factors that contribute to poor management of materials on sites include improper material handling, inappropriate specifications, transport challenges, poor work methodologies, unjustifiable volumes of paper work, inappropriate delivery of materials (schedules and quantities) asserts Zakera et al (1996). Further, the effectiveness of inventory control is measured by how successful a company is at reducing inventory investment; meeting customers' goals and achieving cost containment (Sage, 2013). While it is true that achieving this state is more challenging on construction projects, it is important to buy the correct material quantities at the right time to avoid tying up cash flow. Notably, the industry is faced with many challenges with regard to inventory management. These challenges in inventory management can be categorised as physical, planning and optimisation;

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Physical Challenges - Physical inventory control describes the receiving, movement, stocking and physical control of inventories which involves data entry (Sage, 2013). It becomes challenging to enter data that is not standardised and has many references. This could lead to inconsistent and inaccurate data. The processes of locating and identifying materials on site and in store are physically done. The store's staff will sometimes have to move around just to locate certain materials or components; this exercise is tedious and time consuming leading to project delays (Sage, 2013).

Planning Challenges - In construction procurement planning and demand planning have to be spot on. The procurement has to be done timely to avoid delays and to avoid costs associated with security, insurance, and storage before materials are integrated into the works. Wrong demand planning can lead to overages or shortages. It is common for companies to utilise materials requirements planning (MRP) or Kanban in lean and just in time (JIT). Most contractors rely on security guards to handle the issue of material security; these security guards sometimes do not even have full oversight of the entire site or may be compromised. In addition the process of tracking materials in transit is less or non-automated (Mutumwa, 2005). Therefore; many contractors find it difficult to know the exact date when the required materials will arrive. This uncertainty affects the project scheduling and results in unnecessary costs and delays.

Optimization Challenges - Optimisation is difficult to achieve in inventory management. A good indicator of lack of optimisation is frequent stock outs and stock overages. This is most true for inventory management systems that do not use mathematical calculations. However, the problem is almost non-existent in mathematical systems assuming that the initial calculations and focussing for material supply and needs was accurate and timely. The physical counting of material deliveries on site as well as reliance on delivery notes is non-effective. More so, the processes of reconciling and verifying materials both on and off site is laborious, time consuming and error prone especially during the preparation of the monthly valuation for the work progress or rather when making a claim (Mutumwa, 2005).

The identified challenges are synonymous to the any construction; hence the same can be associated to the ZCI prompt for means of applying effective and efficient material management system. On the other has research (Kasim, et al. 2005) has shown that these challenges can be overcome through the use of ICT-enabled management system can help support the effective management of material activities.

2.0 INFORMATION AND COMMUNICATION TECHNOLOGY (ICT)

Information Technology (IT) is the use of electronic machines and programmes for the processing, storage, transfer and presentation of information. Communication technology is today an important part of IT**.** Together they make up for the term ICT. Mobile devices range from Notebooks, personal digital assistants (PDA), portable data terminals (PDT), tablet personal computers to smart phones. Today, these devices have increased in style,

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functionality, capacity, application areas, features, usability, etc. Apart from that, other technological advancements include RFID, bar-coding, GPS etc. (Kasim, 2010). In this paper, RFID and Bar-coding are the ICT tools being considered.

2.1 Bar Coding Technology

Barcode technology is an optical type of automatic identification data collection that allows fast, simple and accurate data entry and collection (Swedberg, 2004). From the moment the barcode information is scanned by the barcode reader (scanner), information about an activity can be monitored in real time at a greatly increased speed comparing to manual data entry. Barcodes are highly accurate: 'studies (Rivera, 2004; Sardroud, 2012) show that the entry and read error rates when using bar code technology is approximately one error in one million characters, vs. one error per every 300 characters using manual key entry'.

The first barcodes were in use in the 1950s, commercialized in the 1960s, and then gained more popularity as the Universal Product Code (UPC) was used in the grocery industry in the early 1970s (Rivera, 2004). Nowadays, barcode devices supported by new technology are employed by many companies in manufacturing, healthcare, retail, distribution, education, travel and security. Barcodes consist of black and white lines or so called 'bars' which contain data, such as a serial number, part number, quantity, transaction code, and other information. A variety of barcode standards for their graphical images are known as symbologies which are used by different industries according to their specific requirements. There are over 250 types of barcode symbologies with their unique attributes, but only a few are currently used (Swedberg, 2004). The most common being: linear and two-dimensional. For Automatic Identification Data Collection applications, barcode systems contain four major components: a barcode printer, a label, scanning equipment, and an external database (Schneider, 2003). In order to derive data from the barcode, the label is scanned with an electro-optical system (scanner) by illuminating the label and analysing the reflected beam. This data is then converted from analogy to digital, processed by a decoder and sent to a software system (Farragner, 2004). However, its use is not without limitations. The major limitation of barcode is that it requires light for it to capture the data regarding the items. This presents a challenge that requires alternative technology such as RFID.

2.1.1 General Application Of Bar Coding

Bar coding technology is widely being by many industries in improving their operations. According to Rivera (2004) bar coding has been applied to the following sectors:

Distribution

The barcode plays an essential role when transporting products. Its location is monitored and recorded from point of dispatch to final destination.

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Retailers / Shops

The checkout procedure is less time consuming and it is less likely that mistakes will happen because the checkout operator scans the products barcode which totals the cost of items purchased. This also helps to determine the supply and demand since the supermarket computer system will automatically determine whether more products need ordering so that replacements are placed back on the shelves.

2.1.2 Application Of Bar Coding in Construction

Realizing the benefits of the use of bar-coding, the industry's professionals have adopted its application. Typically, bar codes are used for materials and inventory management. This is intended provide accuracy in data collection, improve productivity and save time. The following are some of the areas in construction where the bar-coding can be applied;

Field Material Control

Bar codes have different applications for field control of bulk and engineered materials. This technology can be used to control receiving, inspection, storage and issue of consumable parts and equipment, and all the items that could be controlled with bar codes. A report can be kept when materials are taken from the storage. These materials can be scanned and the report of issuance of materials can be completed (Rivera, 2004). However, there are other bulk materials such as fill dirt, gravel, and concrete. These resources are identified as bulk because they cannot be directly labelled and will require a container and other mechanisms to enable bar-coding (Rasdorf et al, 1989).

Warehouse Maintenance and Control

When materials are received and stored, the assigned location can be entered into the computer system by scanning the bar codes of the materials. As the project progresses and materials are used, a better overall picture of available materials is accessible for forecasting and scheduling purposes (Rivera, 2004).

Purchasing and Accounting

Forms used for purchasing or other related to cost control can be printed with bar codes. Shipping forms from vendors can include bar codes to facilitate the receiving process (Cornell, 2010).

Inventory Control Applications to Tools and Consumable Material

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Consumable materials, such as rain coats, gloves, safety glasses, are subject to abuse and misuse. Although some time might be spent entering bar code data into the computer system, it might eliminate misuse of consumables. The inventory can be kept up to date as the materials and resources are consumed (Rivera, 2004).

2.2 RADIO FREQUENCY IDENTIFICATION (RFID) TECHNOLOGY

RFID can be viewed as a sister technology to bar code labels. According to Ren et al., (2010), RFID is a generic term for technologies that use radio waves to automatically identify objects. There are three major components of RFID, the reader, the tag and the antenna. The antenna enables the chip to transmit the identification information to a reader. The reader generates or listens to and converts the radio waves reflected back from the tag into digital in-formation that can then be passed on to computers that can make use of it (Rivera, 2004). This depends on whether the tags are internally powered; the RFID is classified as active and passive tags. Active tags are powered by an internal battery and are typically read/write. Passive RFID tags operate without a separate external power source and obtain operating power generated from the reader. They are consequently much lighter than active tags, less expensive, and offer a virtually unlimited operational lifetime. How-ever they have shorter read ranges than active tags and require a higher-powered reader.

2.2.1 General Application of RFID

The RFID market is one of the fastest growing sectors in IT areas and is getting popular in much wider areas such as public transport (Swedberg, 2004), ticketing, security and children caring (Ohkubo et al., 2004) all of which can be attributed to its effectiveness and efficiency. It is also a fast and reliable means of automatically identifying and logging items such as retail products, vehicles, documents, people, components, library books and works of art (Farragher, 2004). Since RFID uses radio waves, there is no need for “line of sight” reading of information, which is one of the limitations associated with barcode systems. With this capability of RFID, tags can be embedded in packaging or in the goods them-selves. In addition, RFID tags are reusable, and can with-stand harsh environments. Consequently, in the past few years the IT industry has developed capabilities such as long reading ranges, increased data capacity, and faster processing of radio frequency operating systems.

2.2.2 RFID Supported Construction Inventory Management

Similar to bar code, RFID applications in construction are mostly intended to provide accuracy in data collection, improve productivity and save time in the data collection process. The RFID-supported construction materials inventory management system in that regard, aims at tackling the dynamic nature of construction material management by integrating the information flow among design and material planning team, warehouse, site office, construction site and material monitoring staffs (Sardroud, 2012). The integration is achieved with the support of RFID technologies which help to collect and monitor the material flow, storage, usage, change in a more active and accurate way. The system focuses on the improvement of the material

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management information flow and actively data collection and monitoring. It targets on the seamless integration of the application of new technology with classic construction material management theories and practices.

2.2.3 RFID Application in construction materials management system

RFID can be applied in managing materials on the construction industry through the following;

Material planning
Project planners identify all the key construction materials from the project drawings, bill of quantities and specifications. This work is started while preparing the bid and further refined in the project buyout stage. All these key materials are coded with unique Ids. These IDs, names, technical features, specifications, usages, design drawing numbers, manufacturers, together with the scheduled site and data are input into the material database (Moselhi at el., 2006).

Dynamic material database
This is the core of the system which is accessible online by all the relevant project parties. The database is created in the stage of material planning process, and can be updated based on their information (Ren, 2010). The relevant parties, especially project planners, will be notified immediately regarding any severe material problems (e.g. shortage or mistake).

Material inventory
After the key materials are delivered to the store, they have RFID tags attached. Relevant coding information about the materials is input into the RFID tags and the dynamic material database. Meanwhile, when materials are delivered from the store to the site, the readers installed at the main gate will report the information to the database (Ren, 2010).

Material monitoring and control on site
Portable reader and other supporting facilities on site allow site engineers to track the material delivery, on site storage, installation, progress and changes. This information is sent to the dynamic material database, and the other project teams will be able to obtain the material information in real time. Having identified key materials from the drawings, planning and schedule, the project staff can make a quick comparison and analysis to decide whether to make another order of materials or to change the initial material plan (Sardroud, 2012).

Re- planning and scheduling
Key project management staff can compare the live information received with the material plan, schedule and design to identify and predict problems, and to take corrective actions (Ren, 2010).

On the other hand, the application RFID in the construction industry comes with the limitations. Jaselskis and Anderson (cited in Wang et al. 2007) further noted that these limitations include interference from surrounding metal objects and equipment, setting up costs and attitude of the

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workforce. However, the benefits such as accuracy and ease of use in material management (Sardroud, 2012) have seen an increase in the use of RFID in the construction.

2.3 Benefits of ICT Supported Inventory Management

Significant gains can be made in materials management through the use of automated identification systems such as bar-coding or RFID despite the cost of the equipment, printer, scanner, and media. There will be greater opportunities for improvement in productivity and quality, and less emphasis on manual labour relating to reading, recording and transcribing of data (Moselhi at el., 2006). The delays caused by insufficient amounts of materials, can be controlled effectively by proper materials management. Automating a materials management system can potentially reduce project costs by improving labour productivity, reduce materials surplus, and increase reliability of information (Kasim at el., 2010). The summary of the benefits and costs associated with the implementation of RFID and bar-coding in construction materials inventory management is presented in Table 1.

Table 1: Cost/benefits analysis of automated ID technology in materials inventory management

No	Benefits	Costs
	Supports integrated project planning and scheduling	Equipment
	Paper work can be reduced or eliminated	Implementation
	Operational costs are lowered	Training
	Cycle times are reduced	Maintenance
	Increased efficiency and productivity	Operational
	Higher customer service levels	System breakdown
	Better space utilization	Security
	Employee satisfaction	
	Integrated supply chain	
	Ensure the availability and quality of material	
	Ensure the right time and place of material delivery	
	Reduction of errors and rework	
	Reduction of time overrun and material waste	

Source: Adapted from Kasim (2010)

Essentially the benefits of incorporating Auto Identification Technology in construction materials inventory management outweigh the cost associated with it. It is also important to note that contractors may not need to buy all the equipment needed as they may already have some

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such as computers and internet facilities in their normal office setup thereby lowering the cost of implementation.

3.0 METHODOLOGY AND FINDINGS

Qualitative and quantitative approaches were adopted in this study for triangulation as well as effectiveness since it helps to limit biasness (Johannes, 2004).

The research targeted contractors registered in grades 1-3. These were targeted because of the nature of projects they handle; projects which usually involve assembling of huge volumes of materials or components, hence making them more suitable for the study. Considering that, the following sample frame in Table 2 was drawn;

Table 2: Sample sizes

Population category	population size	Sample size	Successful responses	Response rate (%)
Grade 1	47	15	12	80
Grade 2	36	11	8	72.73
Grade 3	50	16	10	62.5
Total	133	42	30	71.43

Source: NCC, 2013. Sample sizes and Response rates

3.1 Findings and Analysis

From the primary data collected, the research revealed the following;

Assessment of the use of technology in material handling

The findings revealed that 80% of respondents never use any technology in counter checking the quantities of materials received or delivered on site, with 20% of the respondents describing it as being highly applied. This shows that the use of ICT in material handling in the ZCI is very low making the industry vulnerable to cost escalation due to poor and inefficient management of materials. Evidently with a large percent of respondents rely on a manual system, it can be concluded that the system is labour intensive and error prone.

Challenges encountered with materials verification and reconciliation on delivery

The findings revealed that 73% of the respondents pointed out the tedious manual process as being a major challenge encountered with materials verification and reconciliation on delivery. Other challenges include receiving of wrong quantities (47% of the respondents), with 12% of the respondents citing the arrival of wrong materials. And 21% respondents indicated material pilferage as another challenge encountered with materials verification and reconciliation on delivery. Furthermore 10% of the respondents highlighted material damages as being another issue being faced with.

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Assessment on the use of technology in tracking of materials in transit

The findings reveals that 80% of respondents neither use any technology in tracking of materials in transit nor have a very low usage, with 20% of the respondents indicating a high use of ICT. The challenges indicated for not use ICT in tracking materials was its associated high cost. This is indicates that contractors do not know when their materials will be arriving which presents a challenge in planning their works.

The use of technology in ensuring materials security on site and in store

The findings indicated that 46% of respondents neither use any technology in ensuring materials security on site, 47% described their use of technology as moderate while only 7% of the respondents indicated a high usage. The most common form of security on construction was engaging a watch man.

Assessment of the levels of material pilferage (theft)

The findings indicate that at least 80% of the respondents engaged in this research do experience certain levels of material pilferage, though the levels vary but what is evident is that pilferage is an issue affecting the Zambian construction industry which needs to be solved and the use of ICT is no doubt one of the most effective measure in this regard. As a consequence, due to the high rate of pilferage, some materials are procured more than once leading to escalated construction costs.

4.0 CONCLUSION

Information and Communication Technology (ICT) has been widely applied across many sectors in order to increase competitiveness and reduce costs and is today seen as a vehicle to gain a competitive advantage. In the construction industry much effort has been made to improve processes with the help of Information and Communication Technology (ICT), but the industry has not achieved increased productivity to the same extent as many other business fields. This is because while the utilization of ICT was high in the design phase and in facility management, the use of ICT by contractors and site workers in the production process is surprisingly low. Therefore, in addressing the highlighted challenges it is recommended that the use of Auto Identification Technology namely bar-coding and Radio Frequency Identification be quickly embraced and implemented as the way forward in improving and achieving effective material management in the Zambian Construction Industry which characterised with manual material management and high pilferage levels.

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KNOWLEDGE EXCHANGE IN CONSTRUCTION PRACTICE:

EXPLORING THE IMPACT OF EMBEDDED BIM PROCESS STANDARDS

Energy Maradza[1]

Abstract

Research on innovation in construction investigates the role of standards. While studies examine product standards, process standards have influence on knowledge exchange. The research draws on the construction innovation literature to investigate the implications of Building Information Modelling (BIM) process standards on the drivers of innovation in construction practice. BIM involves firms using new process standards to coordinate work between interdisciplinary organisational teams. The standard aims to regularise information management activities between the different teams during construction. To understand the implications of the process standard on knowledge exchange, a case study is conducted with the UK operations of a multinational construction firm. The paper focuses specifically on role played by the Publically Available Specification (PAS) 1192 standard on infrastructure design. Data is drawn from: a) three workshops involving the firm, a wider industry group and an IT supplier, b) observations of practice in the firm's BIM core team and in three ongoing large infrastructure projects, c) 12 semi-structured interviews; and d) secondary publications. Thematic analysis suggests that in practice PAS 1192 is embedded in design technologies and users are unaware of its unconscious effects on knowledge exchange activities. As a result, users are at times unable to identify its immediate benefits. Within the firm the process standard interactions between engineers and site operatives. Externally, knowledge sharing relationships with other construction firms, government agencies, universities and suppliers are changing. In addition, the firms BIM manager, interacts with standards developers and information technology suppliers to access knew knowledge and provide feedback to improve on the firm's existing stock of knowledge.

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The research contributes by articulating how BIM process standards unconsciously change knowledge exchange relationships in construction practice. Further research could investigate these findings in the wider construction industry.

Keywords: BIM, process standards, construction innovation, interactive learning, innovation systems

1.0 INTRODUCTION

Literature on innovation in the construction practice underlines the importance of knowledge exchange (Bossink, 2004, Gann, 2000) in stimulating production and competitiveness in firms. Knowledge is an essential element for competitive production, learning and development in firms (Dulaimi et al., 2002, Nonaka and Takeuchi, 1995b). Construction firms create, accumulate and exchange knowledge from their systemic innovation contexts to address problems, particularly design and construction related problems (Salter and Gann, 2003). However, studies report the challenges faced by construction firms in creating and sharing both tacit and explicit knowledge, especially in project based settings where interactions are often temporary, complex and involving interdisciplinary teams (Winch, 1998). In such social contexts, construction firms tend to rely on standardised processes to facilitate knowledge flows (Gann and Salter, 2000).

Standard processes are integral to the design and construction of the built environment (Whyte and Lobo, 2010). In UK construction, standards have produced mixed results in terms of cost and time savings (Morton and Ross, 2008). Scholars have reviewed albeit to a limited extent, the role of standards in managing multi-disciplinary interactions in temporary project based organisational teams that characterise today's construction environment (Gann, 2000, Slaughter, 1998). Over the past six decades a number of high profile United Kingdom (UK) government sponsored reviews have suggested the use of standards to improve productivity and reduce construction costs (Works, 1964, Construction Task Force, 1998, Joint Government and Industry Construction Review, 1994). In the last decade, there has been a number of initiatives involving collaborations between academics, public and private organisations to advance the use of standard practices (BSI, 2010, BuldingSmart-UK, 2013, East, 2012, Nisbet, 2012, Avanti, 2006). Recent efforts have culminated in the Building Information Modelling (BIM) process standards with USA collaborations (NIBS, 2012). Having trialled the new process standards in some public contracts, the UK government recently mandated their use on all public contracts by the year 2016 (Cabinet Office, 2011).

BIM provides a new mode of managing the digital representation of building design, construction and operation information throughout the built asset's life. In the UK, BIM has been described as a tool for facilitating collaborations between professionals involved in construction practice (Nisbet, 2014). Although there appears to be some differences in how BIM is defined,

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there is some consensus among academics and industry practitioners that BIM aims to provide common structured processes of managing information in construction. Some of the BIM process standards include the Industry Foundation Classes (IFC), Publicly Available Specification 1192, Uncials and the Construction Operation Building information exchange (COBie) standard. The purpose of these standards is to regularise information creation, storage, exchange and communication processes (Nisbet, 2014, BSI, 2010). By using BIM process standards, firms expect to improve productivity, efficiency, reduce risk and foster long term collaborations with other organisations involved in construction (Nisbet, 2012), however the implications of using such standards crucially on the construction firm's knowledge exchange activities remain less studied. Recent studies have also suggested limited awareness of the process standards especially among site engineers (Maradza, 2014), reflecting potential challenges to the management of knowledge in construction.

The construction innovation literature articulates the importance of knowledge creation, however it is yet to examine the relationship between process standards and knowledge exchange. This research aims to address this by providing an in-depth account of the use of the PAS 1192 process standard in a multinational UK construction firm. While the importance of standardised processes to design and construction activities is recognised (Gann, 1996); the dynamics at play, particularities, complexities and context dependant issues which arise as standards get implemented in practice receive less attention from construction innovation scholars. As BIM increasingly gets integrated into UK construction (NBS, 2012, NBS, 2013), this research is useful to inform the management of innovation in construction and the strategic implementation of BIM in construction firms.

The paper is structured in sections as follows: the next section provides a theoretical background of innovation in construction. The third section explains the research design chosen. The forth sections examines the empirical findings and section five discusses the implications of the findings on the literature. The conclusion presents the contributions to theory and practice, explores opportunities for further research in this area.

2.0 THEORETICAL BACKGROUND

2.1 Knowledge and innovation

The knowledge based idea of understanding economic activity has gained scholarly attention among innovation systems scholars over the past three decades (Foray and Lundvall, 1998). This idea places knowledge at the core of innovation activities in global and local economies. At the centre of the argument is that the process of innovation is systemic and influenced to some extent by the processes of knowledge production, knowledge use and the adaptation of knowledge to meet market demand (Pavitt, 2003, Fagerberg et al., 2005). As globalisation increasingly dissipates the nation state knowledge, scholars have suggested that knowledge will become more important to competitive production in local and international markets (Neef in

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Foray and Lundvall, 1998). While the resource based view of the firm suggests that knowledge is a resource acquired to maximise economies of supplying goods and services to the market, a knowledge based view argues that firms exist to perpetually accumulate and disseminate knowledge (Nonaka et al., 2001).

The knowledge based view of the firm suggests the firm's ability to create and disseminate knowledge is mediated by the environment the firm is embedded in (Nonaka and Takeuchi, 1995b). Knowledge is viewed as subjective, "context specific, relational, dynamic and humanistic" (Nonaka et al., 2000 p.02). Scholars of this view define knowledge as a "process that justifies personal beliefs and *truths"* (Nonaka and Takeuchi, 1995b). This view seems to espouse a belief that knowledge is shared through regularised social interactions (Kogut and Zander, 1996), however this is contrasted by Lundvall and Johnson (1994) who focus more on the use of knowledge arguing that it is a set of skills and competencies. Other scholars of a similar tradition have defined it as a meaningful set of technical skills that result from repeated interactions (Antonelli and Quere, 2002). This later view is useful in that it places more emphasis on the repetitive interactions in knowledge creation and exchange, the localised nature of practice and it's the subjective of knowledge. Lundvall and Johnson further distinguish between know-how, know-what, know-who and know-why. They argue that the type and form of knowledge has implications on how it is used and exchanged. However, scholars interested in the exchange of knowledge in social practice have noted the challenges imposed by complex interactions and interdependent relationships between practitioners (Brown and Duguid, 2001).

Scholars distinguish between tacit and explicit (codified) knowledge (Polanyi, 1969). While explicit knowledge is relational and objective, and exists in forms such as manuals, scientific formulas and data (Nonaka and Takeuchi, 1995a, Foray and Lundvall, 1998); tacit knowledge cannot be easily exchanged through documentation, instead it can only be effectively communicated through experience (Kogut and Zander, 1996). Tacit knowledge exchange is particularly complicated by the fact that it is embodied in humans. While this dichotomisation is perhaps useful in understanding knowledge generally, other scholars have argued that this is not enough. In practice they submit, focus should be more on differences in perspectives formed by humans as they interpret and consume knowledge to suit their unique but shared contexts. According to Brown and Duguid (2001), by focusing on practice knowledge exchange can be understood from the context of shared practices and protocols.

2.2 Knowledge exchange in construction

Construction innovation scholars have investigated the exchange of knowledge in construction firms. While research suggests that codified knowledge can be easily communicated, tacit knowledge they suggest is mostly sharable through observation and imitation (Antonelli and Quere, 2002, Dodgson et al., 2003, Gann and Salter, 2000). Studies note that the nature of construction projects and the forms of work organisation utilised by firms affect the exchange of

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knowledge (Johnson, 2007, Dougherty and Dunne, 2012). Other scholars have noted that tacit knowledge in particular resides in humans; in construction, projects are predominantly made up of temporary human teams that disband upon completion, knowledge exchange is thus an incredibly complicated process (Dodgson et al., 2008, Winch, 1998).

In practice, knowledge exchange is mediated by the project based nature of the environment in which firms are embedded, skills and capabilities, communication and information flows and technological mechanisms (Bresnen et al., 2003). Bossink (2004) has suggested that knowledge exchange in construction happens through internal and external processes. Internally, knowledge is exchange through training, interactions between employees, make use of new applications developed by consultants and lateral communication structures. Externally, he suggests that knowledge is exchanged through participation in collaborations with architects and engineers, employees accessing information from outside and stimulation of research. Salter and Gann (2003) identify face to face interactions with clients and fellow colleagues, electronic scouting on the internet and internal data bases as potential ways of exchanging knowledge in construction.

2.3 Product and process standards

Scholars interpret and ascribe different meanings to the role of product and process standards. In contrast to product standards which address interfaces between components (Farrell and Saloner, 1985), process standards are common, repeatable best practices or voluntary norms which govern human behaviour (Hawkins et al., 1995). Lundvall and Johnson (1994) explain process standards as common codes for communication. Other scholars suggest that they are useful for diffusing technologies, managing market entry for new products and compatibility between different technologies (Freeman, 1995). Nelson and Nelson (2002) argue that they provide a social infrastructure technology transfer.

Construction firms interact with and acquire knowledge from various sources such as clients, material suppliers, universities and professional bodies to design, construct and maintain the built environment (Gann and Salter, 2000). These firms use sets of process standards to create, store, exchange and communicate information. Within the construction innovation literature, standards are viewed by some as a form of regulation to which all construction must subscribe. This applies mostly to technical, safety and quality standards. An alternative is to view standards as tools for useful in the production of goods and services. This view explains that standards are best practices or home grown solutions which seek to manage human behaviour. Whyte and Lobo (2010) for instance explain that standards provide a digital infrastructure for managing interactions in construction. This view shifts analysis towards the role and effects of standards to production processes. In construction practice, analysis might involve examining interactions between practitioners and a particular standard. This might also involve investigating the meanings as constructed by participants as they use a standard.

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There is a distinction between product and process standards. On one hand product standards have received much of the research attention and scholars describe how standardised products are useful in achieving production economies. However, this might limits the client's choice thus affecting demand (Hanseth et al., 2006). The availability of precast units for instance was seen at one point as an important way of speeding up construction activities, however in some sectors demand began to slump as customers increasingly became selective. On the other hand construction as process involves design, construction and maintenance of buildings. According to this view, standard processes have a role to play on the organisation of construction activities. Scholars explain that such standard processes (process standards), involve the integration, structuring, simplification and replication, of work activities to facilitate information flow, regulate interactions between diverse practices and enhance performance in the production of products and services (Davies et al., 2006). This view of process standards appears to suggest that standards are a measure of best practice established over prolonged periods of time. Gann and Salter (2003) have suggested such standards can support knowledge exchange and provide the building blocks for sustained process improvement. However, these scholars appear to refer to routines, rather than consensus driven national or international standards which are external to the construction firm. As a result of diverging views there is a simmering debate on the role of process standards in construction practice.

2.4 Building Information Modelling

Building Information Modelling (BIM) aims to provide a common structured process of managing information in construction. In practice, this supposedly materialises through sets of process standards which seek to regularise information creation, storage, exchange and communication processes (Nisbet, 2014, BSI, 2010). By using BIM, firms anticipate to improve productivity, efficiency, reduce risk and foster long term collaborations with other actors involved (Nisbet, 2012), however the implications of BIM remain less understood especially among engineers (Maradza, 2014). In an attempt to improve BIM uptake, the UK government recently mandated BIM use on all public projects by 2016 (Cabinet Office, 2011). Findings from a few UK government sponsored trial projects indicate that BIM can improve productivity and reduce construction costs (Cabinet Office, 2012), however further investigations are necessary to validate such conclusions. Below are examples of BIM process standards used in the UK.

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Table 1: BIM process standards

BIM process standard
Industry Foundation Classes (IFC) British Standard ISO 16739
Library objects: BS 854 (1-4)
BS1192: 2007, Publicly Available Specification (PAS) 1192 (1-4) including
Object library standards - Uniclass2.
International framework for dictionaries of digital objects ISO 12006 -3:2007 and Digital information delivery manuals: ISO 29481:2010
BIM execution plan
Digital plan of works
Design standards
Construction Building Information Exchange (COBie)

In practice, the above BIM process standards are being implemented together with existing and long established professional standards such as the Rules of Measurement (NRM) for use in the quantity surveying profession developed by the Royal Institution of Chartered Surveyor's (RICS), Civil Engineering standard method of measurement advanced by the Institution of Civil Engineers (ICE) and the plan of works developed by the Royal Institution of British Architects (RIBA).

3.0 RESEARCH METHOD

This interpretive study uses a case study design to provide and in-depth account of the complexities surrounding the use of BIM process standards in a single large multinational construction firm headquartered in France. The firm has been involved in the design and construction of award winning land mark projects across the UK. The firm is selected because of its size (above £1 billion turnover), experience in supporting standards development and participation in government BIM trial projects. In the UK, the firm has 5 divisions and civil engineering division is the largest by turnover. Although BIM is being deployed across the firm, due to time and access limitations, this study focuses only on the Civil engineering division. The aim is to provide a holistic account of using BIM process standards on knowledge exchange, focusing knowledge exchange practices from the perspective of those involved. Therefore the account provided is that of the multiple meanings and mental constructions made by practitioners as they interact and use the standard. By examining interactions between professionals involved in the use of the PAS 1192 standard the study seeks to explore the issues that arise in project based environments.

The case study design is selected because it is useful in studying the "particularity and complexity of a single case, coming to understanding its activity within important circumstances" (Stake, 1995 p.xi) and to provide a holistic account of human experiences (Creswell, 2003). Baxter and Jack (2008 p.544) also argued that case studies "... ensure that the issue is explored through … a variety of lenses which allows for multiple facets of the phenomenon to

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be revealed and understood". The case study design is common in studies of this nature (Gann and Salter, 2000, Miozzo and Dewick, 2004). The selected design is not without challenges, for instance it only captures the views of a limited group of individuals hence generalisation is to an individual's context (Stake, 1978). Despite this challenge, this method enabled rich data to be collected which appreciates the contextual issues surround interactions at multiple levels of analysis. In the process the research captures specific issues in localised contexts, in particular on the use of PAS 1192 in design activities. Wider generalisations are therefore not the priority here; instead the focus is on theoretical generalisation.

Data collection was designed to gather evidence from participants in their natural settings. In order to capture experiences around PAS 1192, a decision was taken to only interview the firm's engineering professional pool. Data is collected over a period of 7 months and it involved interviews, observations and secondary documents collected from the firm's BIM core team and in three ongoing projects. Data collection was done in: a) three hour long workshops involving the case study firm, IT suppliers and a wider industry group on three occasions, b) observations of practice in the BIM core team and in three ongoing projects, c) 12 semi structured interviews; and d) secondary publications from the firm.

Participants were selected on the basis of their role on the project. Through examining the day to day uses of PAS 1192 it was possible to understand how users using a new standard. Discussions focused on what the standard meant to the participant, effect on their work practices and whether it encouraged or hindered their information sharing activities or face to face interactions. The discussions looked at how they learnt about the standard, how they used it to solve design problems and whether the firm had provided special training for them to understand the standard. Interviews were conducted with design engineers, site engineers, site operatives, BIM managers and consultants. A particular disadvantage of this research approach is that it only captures the views of a limited group of individuals, at one specific time period. Despite this, it offers a rich data of the social interactions.

Interview participants were selected to reflect the different design professional disciplines engaged within the selected projects. Project was selected because they had implemented BIM. Interviews were recorded and transcribed by the researcher to engage deeply with the data. Although the interviews are focused at the firm level, they encouraged participants to cite specific examples from their daily experiences. Data is analysed through an iterative process of identifying emergent themes, coding and continuous reviewing of the data to identify aggregate themes and central meanings. Although this study is inductive, concepts established in literature were used to develop an analytical framework for data coding. To improve the research's validity, method triangulation and interview participants were accorded an opportunity to review and revise the transcriptions and subsequent publications (Silverman, 2009).

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4.0 FINDINGS

4.1 The construction firm and its contextual environment

The case study was on construction firm employees just over 6,000 employees in the UK alone. Its global work force is in excess of 60, 000. At the time of data collection, the firm was involved in more than 300 projects in the UK. The civil engineering division of the firm employs about 3 500 employees in the UK only. The Civils division has over 90 years of experience in designing and constructing large scale infrastructure projects across the world. During the 2008 economic downturn the firm acquired this civils division and it has been successfully transformed to profitability. Its UK division's turnover was just over £1.2 billion in 2012. The case study firm's UK turnover was just over £1 billion in 2012. The civil engineering division is currently involved in some of the ongoing large scale infrastructure projects in south east England. The division is involved in airports, education, nuclear, residential and commercial building, rail, hospitals roads, tunnelling and utilities.

The firm is involved in collaborations with IT suppliers to provide cutting edge solutions for built environment. It has a history of championing the use of IT technologies and participating in BIM standards development in the UK and globally. One of the widely development data management technology was developed with the support of the firm. The firm's BIM manager was involved in the development of the PAS 1192 standard. The civils division has been involved in the government sponsored COBie and PAS 1192 trial project which involve collaborating with 11 competitors, 3 standards developers and 4 IT developers. The firm remains in full support of this technology and occasionally acts as a hotbed for trialling changes in the technology. As a result, there is a mutually beneficial relationship between the firm and some of its IT suppliers who are increasingly relied upon to support construction activities through customised digital design technologies. The firm's BIM manager is involved in a number of standard development organizations and has fully implemented the PAS 1192 standard in the BIM core team. However, implementation of PAS 1192 the firm is facing much resistance from project managers who remain wary of the standard. He is overseeing the implementation of BIM throughout the firm. He also had leading role in developing the government's BIM strategy.

4.2 Interactions using the PAS 1192 standard

Research findings suggest a general level of BIM awareness. However, a detailed understanding of specific standards is limited especially among site engineers. When participants were asked to explain the purpose of the PAS 1192 standard, most of them were unable to. Especially those involved on site. When asked if they had used the PAS 1192 standard, again some of the participants were not sure. However, participants were quite happy to discuss their use of the collaboration technology (TX, not real name). TX is embedded with the PAS 1192 standard.

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5.0 KNOWLEDGE EXCHANGE PRACTICES THE CONSTRUCTION FIRM

The theoretical background outlines the context specificity and subjective nature of knowledge. Its exchange is shaped by social interaction. The firm's environment, skills and capabilities, communication and information flows and technological mechanisms influence knowledge exchange. A community based approach is also viewed as one of the means of exchanging knowledge (Bresnen et al., 2003). Findings suggest that the firm used this approach to exchange knowledge by participating in trial projects. However, findings reveal a deeper problem which stems from a limited understanding of standards. Despite the fact the firm contributed to the development of the standard, there is significant resistance to its use by some project managers. In addition users did not quite associate themselves with the standard. This could be the result of its embedded nature as users unconsciously interact with it without being aware of its effects. Moreover this could also be a reflection of wider issues concerning their perception of the standard. It appears that project managers are not confident with the standard hence their resistance to its implementation. Literature suggests that standards are viewed as best practices which emerge over prolonged use. Resistance could explain that the standard is not yet viewed as best practice and its nationalistic nature could be viewed as negatively, i.e. it does not address context specific issues.

Table 3: *Interactions using PAS 1192 standard*

Material suppliers	Codified	Contribution to the digital library of objects required to create IFC models. An example is the national BIM library which is proving an important source of knowledge for BIM modellers in the BIM core team and for the COBie trial project.
Government, Professional bodies and local authorities	Codified	Participation through attending conferences and workshops organised by national bodies and professional organisations such as the ICE, RICS and the BIMtask group
Standards Development Organisations	Tacit and Codified	The contractor's BIM manager is involved in and participates in SDOs such as BuildingSmart. This allows the firm to access information on latest COBie developments.
Universities and other research organisations	Codified	Participation in the COBie trial project. Workshops organised to address COBie implementation issues.
Other project based firms	Tacit and Codified	Collective action in participating in the COBie trial project. Workshops organised to address COBie implementation issues.
IT suppliers	Tacit and Codified	Participation in the COBie trial project and providing feedbacks for solving day to day problems in integrating COBie with other digital design tools. Contributing to the national BIM library of digital objects.
Internal resources	Tacit and Codified	Face to face interactions, internal meetings and simulations. Consultants employed by the firm in design and build contracts
Clients	Tacit and Codified	Participation in the COBie trial project and providing feedbacks at seminars and conferences

The findings suggest that in practice users interact with standard unconsciously due to its embeddedness. Findings suggests that during the use standards knowledge exchange occurs

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internally such as the use of training, interactions between employees, make use of new applications developed by consultants and lateral communication structures as suggested by Bossink (2004). Knowledge exchange externally is characterised by interactions with other firms, face to face interactions with clients, electronic scouting on the internet and internet data bases. These findings suggest that BIM process standards support knowledge exchange and thus the process of innovation in construction. Previous research suggests that face to face interactions are important for sharing knowledge (Salter and Gann, 2003), however using BIM process standards is influencing the firm's interactions. New networks are emerging and existing interactions are being reshaped in construction (Maradza et al., 2012.). Interactions with the government, other firms, standards developers and IT suppliers are considered important for accessing new knowledge and keeping ahead of competitors. This explains a strategy to engage in pilot projects and the trial project. While standards were found to be simplifying practice since they are invisibly incorporated into practice, challenges observed were that users are not aware they are complying with a standard and thus they are unable to provide suitable feedback to further perfect the standard and subsequently the coordination technology. This could also limit the extent to which the standard is used to facilitate knowledge exchange activities within the firm.

6.0 CONCLUSION

The research has examined the use of BIM process standards in construction practice with an aim of understanding its effects on knowledge exchange. In the context of evolving and dynamic construction practice, the research has shown the challenges of using a new standard especially a national standard. However, findings suggest that standards are facilitating knowledge exchange when users are acquainted with them. They also stimulate changes in interaction dynamics with IT suppliers taking a more influential role. Further research could examine the wider implications on innovation in construction. As interdependent teams execute work in construction, research of this nature is important to show some of the issues that arise as firms implement new national standards.

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DEVELOPING AN ENABLING ENVIRONMENT TO MAXIMISE E-PROCUREMENT ADOPTION IN THE SOUTH AFRICAN CONSTRUCTION INDUSTRY

Samuel Laryea[1], Eziyi Ibem[2]

Abstract

The aim of this paper was to explore how the current environment of electronic procurement in South African construction industry can be improved to help in maximizing the diffusion and adoption of electronic procurement when it comes to the acquisition of construction works and services. Electronic procurement refers to the use of electronic communication systems and applications to buy services, goods and works or conduct tendering for construction works. While there is growing evidence of application and benefits of e-procurement in some countries, the use of e-procurement in South Africa has been limited and patchy, implying that the benefits are currently not being maximised to support economic growth and industry development. We explore some of the ways in which this problem can be addressed. The paper is organised into four parts. In the first part, we discuss general factors that enable e-procurement adoption based on evidence reported in the literature. These are the regulatory framework and policies guiding procurement; ICT infrastructure; and technology uptake by people. Second, a discussion of the three factors within the context of South Africa is presented. Third, an online survey was conducted in which 23 respondents gave an indication of the extent of their awareness and adoption of e-procurement in the South African construction industry. While 70% of respondents were aware of electronic procurement, only 33% of them had actually used e-procurement. Fourth, we conclude by discussing some of the ways in which the use of e-procurement can be diffused and maximized in the procurement of construction work in South Africa. Of the three main enablers of e-procurement, two are found to be quite sufficient i.e. the country's market and regulatory framework in supporting ICT uptake; and there is also a good ICT infrastructure environment. The main area of concern relates to technology uptake by people in the construction industry. This requires major cultural and organisational changes that can be brought about by targeted initiatives championed by, for example, CIDB, CBE and major procurers; investment in technology by firms; and clear roadmap for transitioning to e-procurement in appropriate areas of construction procurement.

Keywords: e-procurement, e-readiness, ICT infrastructure, online survey, Networked Readiness Index, procurement policy and framework, technology uptake

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1.0 INTRODUCTION

The concept of electronic procurement refers to the use of electronic communications to buy services, goods and works or conduct tendering for construction works (adapted from the European Union definition). Despite the advanced use of e-procurement in developed countries for acquisition of construction goods, services and works, the adoption of e-procurement in the South African construction industry has been limited and patchy. The aim here was to examine the e-procurement environment in South Africa, compare it with the e-procurement environment in leading countries where it is adopted, and discuss ways of improving the South African environment to help maximise the diffusion and application of electronic procurement in construction. The regulatory and policy environment for procurement in South Africa is reviewed. This is followed by a discussion of the information and communication technology environment. By examining Networked Readiness indices of leading e-procurement adopters with that of South Africa, the discussion focuses on ways of enhancing South Africa's environment and practices to maximise e-procurement adoption.

2.0 RESEARCH APPROACH

The study is part of an on-going research project designed to investigate e-procurement adoption in the South African construction industry. The data reported were obtained from the review of literature, documentary analysis and a pilot survey conducted between July 2013 and January 2014. Data for the first objective of the study were obtained through extensive analysis of the different pieces of legislation and policy documents that regulate procurement practices in South Africa. Table 1 is a summary of the documents analysed. For the second objective, the main literature analysed is the Global Information Technology (GIT) Report 2013. To identify any evidence of e-procurement use, which is the third objective of the study, a pilot survey was conducted between 4th of December 2013 and ended on the 31st January 2014. The target population for the survey was professional consultants (architects, engineers, and construction and project managers, quantity surveyors), client organizations and contractors. A short questionnaire containing for questions, relating to (i) the role of the respondents in the South African construction industry (ii) level of awareness of the use of e-procurement in construction (iii) whether or not the organization has used e-procurement in procuring construction works, services or supplies; and (iv) whether the respondents have personally participated in a construction project that involved the use of e-procurement. Data for the pilot survey were collected through an online survey using the qualities online survey software. Of the 29 respondents who participated in the online survey, 23 provided useful information that was included in the analysis.

Due to the nature of data collected, two types of analyses were conducted. The first was content analysis, which was used in the analysis of data collected from the literature review and

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documentary analyses. This analysis helped in the identification of the different pieces of legislation that have implications for e-procurement practices; and the state of ICT environment in South Africa. The second analysis conducted was simple descriptive statistical analysis. This was used to analyse data derived from the online questionnaire survey.

3.0 FACTORS ENABLING THE ADOPTION OF E-PROCUREMENT

When it comes to factors enabling e-procurement adoption, two concepts that should be explained to provide a context are e-readiness and Networked Readiness.

E-readiness is a measure of the degree to which an organization, a society, or a country may be ready, willing or prepared to obtain benefits which arise from Information and Communications Technologies (see explained in a paper by Goulding and Lou (2013) on e-readiness in construction). E-readiness is the preconditions necessary for e-commerce, e-government, e-development and e-procurement. In the past, an E-Readiness Index has been published for countries by the Economist Intelligence Unit. This index is a statistical measure composed of quantifiable set of indicators and summarized broad set of characteristics to describe an organization, a society or a country's e-readiness. The higher the e-readiness index of a country, the better prepared it is for adoption of e-government or e-commerce (see The Global Competitiveness Report 2013–2014 published by Klaus Schwab for the World Economic Forum). A study by Ifinedo (2005) on e-readiness of nine African countries in the global networked economy concluded that "the mean e-readiness of Africa is poor in comparison to other economies. Particularly, Sub-Saharan Africa (SSA) - with the exception of South Africa and its neighbours - has a poor e-readiness score".

The Networked Readiness Index (NRI) measures the propensity for countries to exploit the opportunities offered by information and communications technology (ICT). The Global Information Technology Report (GITR) and the Networked Readiness Index (NRI) was created in 2001. It enables decision makers and investors to adopt business and financial strategies that would allow them to develop in the context of a fast-moving but nascent Internet economy (Bilbao-Osorio et al., 2013). The NRI provides a better understanding of the impact of ICT on the competitiveness of nations. It comprises of three components: the environment for ICT offered by a given country or community (market, political, regulatory, and infrastructure environment), the readiness of the country's key stakeholders (individuals, businesses, and governments) to use ICT, and the usage of ICT among these stakeholders.

There seems to be a close relationship between e-readiness / Networked Readiness index and e-procurement uptake in countries (see Table 3). A study conducted by Westcott (2002) indicated that the leading countries when it comes to e-procurement usage are US, Japan, Sweden, Australia, UK and Ireland. A close examination of the GTI Report 2013 (Bilbao-Osorio et al., 2013) shows that the leading countries when it comes to e-procurement adoption also score high when it comes to the Networked Readiness Index (NRI) published in the Global

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Information Technology (GIT) Report 2013. This may imply that the factors enabling e-procurement adoption are closely related to e-readiness and Networked Readiness. Therefore, the factors enabling e-procurement adoption may be summarized as (1) the regulatory framework and policies guiding procurement; (2) ICT infrastructure; and (3) technology uptake by people in industry and business. This position is supported in part by research on e-procurement by Goulding and Lou (2013). These factors provide a context for discussion, and clearly need to be addressed in the South African environment in order to maximise e-procurement use.

4.0 REGULATORY AND POLICY ENVIRONMENT FOR PROCUREMENT IN SOUTH AFRICA

Although there are several definitions of procurement in the literature, the definition of procurement adopted in this study is drawn from two documents. The first is from the Wealden District Council document on procurement strategy (2011:2), which defined procurement as "*the process of acquiring goods, works and services, from both third parties and in-house providers*". The second is from the International Standard Organization Procurement document (ISO 10845-1, 2010), which also defined procurement as a succession of logically related actions occurring or performed in a definite manner and which culminate in the completion of a major deliverable or the attainment of a milestone. In a conceptual paper on a BIM-based integrated perspective to challenging electronic procurement in the AEC Sector, Grilo and Jardim-Goncalves (2011) explained that procurement is broader in scope than purchasing, because it encompasses both strategic and operational activities such as searching for requirement information of goods and services, their availability delivery arrangement, actual acquisition and delivery. The above definitions are very insightful as they indicate that procurement is more than mere purchasing, but a process comprising a sequence of closely-related activities that lead to obtaining deliverables such as acquisition of goods, utilities, services and works form supplies or vendors at the agreed price, time and legal terms.

In the context of the construction industry, the internationally accepted definition of construction procurement is also found in ISO 10845-1 (2010). According this document, construction procurement is a process through which contracts relating to the provision of goods, services and engineering and construction works or disposal, or any combination thereof are created, managed and fulfilled. It involves the procurement of materials, goods, equipment, professional and non-professional services required for the actualisation of construction projects as explained by Grilo and Jardim-Gonclaves (2011). Following from the above, e-procurement as applied to construction is the use of electronic systems and applications to acquire goods, equipment, professional and non-professional services for construction projects. It entails the use of electronic systems and applications to advertise for tender offers from professional consultants and contractors, exchange of project data and information, conduct tendering, evaluate tenders or proposals, award and management construction contracts.

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From the review of international literature, it was found that greater part of construction procurement activities are conducted electronically in most developed countries such as Australia, Canada, Russia, the UK and USA. Studies also show that in the different countries, several factors, including cost, cultural, legal, interoperability (Issa et al., 2003; Zou and Seo, 2005), ICT infrastructure, personnel, regulatory/policy environment and security issues (Eadie et al., 2011; Oyediran and Akintola , 2011) have influenced the use of e-procurement at the project, organizational and industry levels. In a study that examined the implementation of the World Bank's e-Procurement initiatives in the selection of consultants, Leipold *et al*. (2004) specifically explained that the ICT infrastructure and procedures engaged in by the World Bank in selecting consultants for its projects across the world were among other things determined by the existing public sector procurement policies and regulations. Similarly, in a multiple case studies on e-procurement implementations in Italy, New South Wales, New Zealand, Scotland and Western Australia by the Australian Government Information Office (2005), it was observed that e-procurement use was influenced by diverse socio-technical, institutional and policy contexts in the different countries. This was corroborated by a recent multiple case studies of five major e-procurement projects in UK-based public sector agencies by Doherty et al. (2013), which also found that procurement in the public sector was often constrained by institutional, political and regulatory factors. Further, in a conceptual paper that sought to develop a theoretical impact-role-factor assessment model to assess the importance of government, organizations and technology on a construction enterprises' e-procurement readiness level in the developing countries, Tran *et al*. (2011) noted that some of the roles of government in promoting e-procurement use included the provision of supportive policies and programmes; IT infrastructure, legal and regulatory framework. The above obviously suggest that regulatory, policy and ICT environment are enablers of e-procurement use.

Table 1: Pieces of legislation affecting procurement in South Africa

S/N	Acts (various pieces of legislation)
1	Arbitration Act (Act 42 of 1965)
2	Auditor – General Act (Act 12 of 1995)
3	Broad-Based Black Economic Empowerment Act, 2003 (Act No. 53 of 2003)*
4	Competitions Act (89 of 1998)
5	Constitution of the Republic of South Africa, 1996 (Act No 108 of 1996)*
6	Construction Industry Development Board Act, 2000 (Act 38 of 2000)*
7	Electronic Communications and Transactions Act (Act No. 25 of 2002
8	Local Government: Municipal Finance Management Act, 2003 (Act No 56 of 2003)*
9	Local Government Municipal Systems Act, 2000 (Act No 32 of 2000)
10	Preferential Procurement Policy Framework Act, 2000 (Act No 5 of 2000)*
11	Prevention and Combating of Corrupt Activities Act, 2004. (Act No. 12 of 2004)*
12	Protected Disclosure Act (Act 26 of 2000)

Continued Table 1: Pieces of legislation affecting procurement in South Africa

13	Promotion of Access to Information Act, (Act 2 of 2000)
14	Promotion of Administrative Justice Act (Act 3 of 2000)*
15	Public Protector Act (Act 23 of1994)
16	State Information Technology Agency Act (Act 88 of 1998)
17	The Conventional Penalties Act (Act 15 of 1962)
18	The Promotion of Equality and the Prevention of Unfair Discrimination Act, 2000 (Act 4 of 2000)*

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In the context of South Africa, literature survey reveals that there is a dearth of empirical studies on e-procurement use in the construction sector. However, a number of studies on the procurement practices in the country were identified. For instance, Watermeyer (2003) explained that in recent years, South Africa has witnessed some fundamental reform in the regulation of procurement, and is one of the countries in the world to have procurement subject to its constitution. Bolton (2006) in a study of government procurement as a policy tool in South Africa noted that before 1994, government procurement system in this country was in favour of large and established enterprises owned by whites and excluded newly established businesses. He further explained that since 1994 when public procurement system was granted constitutional status, and was recognised as one of the ways to addressing past discriminatory policies and practices things have changed significantly. In a study on procurement challenges in the South African public sector Ambe and Badenhorst-Weiss (2012) added that reforms in public procurement in the country were initiated to promote the principles of good governance and address inconsistency in policy application, lack of accountability, supportive structures and fragmented processes.

One of key aspect of the reform in the procurement system of South Africa was the enactment of several legislation and policies to regulate procurement practices in the country. In fact, Watermeyer (2011) identified eighteen of such pieces of legislation that impact on construction procurement in South Africa (see Table 1) Ambe and Badenhorst-Weiss (2012) identified nine pieces of legislation, including the Public finance Management Act 1 of 1999 and the eight other Acts asterisked in Table 1 as forming the regulatory framework for procurement practices in the country.

From the studies cited in the preceding paragraph we understand that 19 different pieces of legislation exist that regulate procurement practices in South Africa in several ways. These pieces of legislation are known to regulate procurement practices in South Africa by setting out the general principles for public procurement and establishing the regulatory framework, administrative procedures, manner for implementing preferential procurement policies and a code of conduct for parities engaged in construction procurement. However, these studies are silent on the implication of these pieces of legislation for e-procurement in the country. This is one aspect of the existing gap in the literature this study attempted to fill.

5.0 TECHNOLOGICAL ENVIRONMENT FOR E-PROCUREMENT IN SOUTH AFRICA

As noted earlier, the ICT infrastructure environment has significant influence on e-procurement use in the construction industry in particular and other sectors in general. Therefore, for the purpose of our analysis in this paper, the technological context of e-procurement application is seen from the lens of the ICT environment of South Africa. The basis of our analysis and discussion is the Network Readiness Index (NRI) framework used in assessing the ICT infrastructure in the different countries across the world as presented in the Global Information

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Technology (GIT) Report 2013 (Bilbao-Osorio et al., 2013). The data used in the GIT report are derived from a survey of the ICT environment in the different countries and published by the World Economic Forum.

The Networked Readiness Index (NRI) is a framework that measures access and usage of ICT infrastructure, digital resources, software and skills and some of the economic and social impacts accruing from ICTs as explained in the Global Information Technology (GIT) Report (2013). Among other things, the NRI measures the (i) friendliness of a country's market and regulatory framework in supporting high levels of ICT uptake (ii) degree of a society's preparation to make good use of an affordable ICT infrastructure (iii) efforts of the main social agents—that is, individuals, business, and government to increase their capacity to use ICTs as well as their actual use of ICTs in day-to-day activities; and (iv) broad economic and social impacts accruing from ICTs and the transformation of a country toward an ICT- and technology-economy and society (see Bilbao-Osorio et al., 2013:xii).

Specifically, the network readiness framework comprises of four sub-indexes that measure (i) the ICT environment (political, regulatory, business and innovation environments) (ii) the readiness of a society to use ICTs (infrastructure and digital content, affordability and skills) (iii) the actual usage of ICTs by all main stakeholders (e.g. individuals, businesses, government) and (iv) the impacts that ICTs generate in the economy and in society (economic and social impacts) see Figure 1). As explained in the GIT Report 2013 the first three sub-indexes can be regarded as the conditions that facilitate the result of the fourth sub-index. In assessing the ICT environment, countries are scored based on these four sub-indices. Therefore, the NRI score represents average of the four sub-index scores; and thus higher NRI means better access and usage of ICT infrastructure, digital resources and greater economic and social impacts accruing from ICTs. In assessing the ICT environment, countries are scored based on these four sub-indices. The latest GIT Report 2013 indicates that the top three ranking countries of the 144 surveyed in terms of RNI are Finland with RNI Score of 5.98, Singapore (5.96) and Sweden (5.91), respectively. The lowest ranked country is Burundi with RNI Score of 2.30.

Table 2: Networked Readiness indicators for South Africa

Networked Readiness variables	Rank (out of 144)	Score 1-7
Networked Readiness Index 2013	70	3.9
Networked Readiness Index 2012 (out of 142)	72	23.9
Environment Subindex	33	4.7
1st Pillar: Political and Regulatory Environment	21	5.0
2nd Pillar: Business and Innovation Environment	55	4.4
Readiness Subindex	95	4.0
3rd Pillar: Infrastructure and digital content	59	4.2
4th Pillar: Affordability	105	3.9
5th Pillar: Skills	102	4.0

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Usage Subindex	72	3.5
6th Pillar: Individual usage	81	3.0
7th Pillar: Business usage	33	3.9
8th Pillar: Government usage	102	3.7
Impact Subindex	92	3.2
9th Pillar: Economic impact	51	3.5
10th Pillar: Social impact	112	3.1

Definition of parameters
The environment subindex gauges the friendliness of a country's market and regulatory framework in supporting high levels of ICT uptake and the emergence of entrepreneurship and innovation-prone conditions. A supportive environment is necessary to maximize the potential impacts of ICTs in boosting competitiveness and well-being.

The readiness subindex measures the degree to which a society is prepared to make good use of an affordable ICT infrastructure and digital content.

The usage subindex assesses the individual efforts of the main social agents—that is, individuals, business, and government—to increase their capacity to use ICTs as well as their actual use in their day-to-day activities with other agents.

The impact subindex gauges the broad economic and social impacts accruing from ICTs to boost competitiveness and well-being and that reflect the transformations toward an ICT- and technology-savvy economy and society.

Data Source: Bilbao-Osorio et al. (2013)

An examination of data summarized in Table 2 shows that the ICT environment in South Africa is sufficiently adequate to support the diffusion and maximisation of electronic procurement. South Africa ranks in the top 30% of countries in the world when it comes to quality of ICT infrastructure so there is a good enabling ICT environment. However, the quality of ICT infrastructure may not be the same throughout the country. Hence a main area of concern will relate to access of smaller firms in lesser developed areas to ICT facilities required to support a competitive business environment. The major problem areas from the data in Table 2 relate to Readiness subindex and Usage subindex. A comparison of South Africa with leading countries when it comes to e-procurement adoption and their networked readiness indices is shown in Table 3. Eadie *et al*. (2007) citing earlier work by Wescott and Mayer (2002) on e-Tendering from UK and European perspective noted that in terms of global ranking in the uptake of e-procurement in goods and services, the USA is number one, followed by Japan, Sweden, Australia, the UK and Ireland, respectively

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Table 3: The rankings of with South Africa six major e-procurement adopters

			Parameters for measuring NRI 2013			
Countries	Rank of country in terms of e-procurement usage (Westcott, 2002)	Rank out of 144 countries in GIT (2013) Report	environment subindex	readiness subindex	usage subindex	impact subindex
South Africa	-	70	33 out of 144	95 out of 144	72 out of 144	92 out of 144
Unites States	1	9	16 out of 144	4 out of 144	13 out of 144	10 out of 144
Japan	2	2	26 out of 144	28 out of 144	9 out of 144	17 out of 144
Sweden	3	3	5 out of 144	3 out of 144	1 out of 144	4 out of 144
Australia	4	18	11 out of 144	25 out of 144	18 out of 144	18 out of 144
United Kingdom	6	7	6 out of 144	10 out of 144	11 out of 144	8 out of 144
Ireland	7	27	15 out of 144	16 out of 144	28 out of 144	33 out of 144

Data Source: Bilbao-Osorio et al. (2013)

Relating this to the GIT Report 2013 on the NRI of these six countries it seems evident that only Sweden, which ranked number three position according to the NRI score was among the top six adopters of e-Procurement in 2002. It is however intersting to observe that all the top six ranked countries in terms of e-procurement use in 2002 are among the top 21% of the 144 in RNI scores in 2013. Arguably, this goes to suggest that there is a relationship between the RNI scores and e-procurement use.

It was important to unpack the variables relating to Readiness subindex and Usage subindex to develop a better understanding of the 'real' problem areas (see Table 4). It was important to unpack the variables relating to Readiness subindex and Usage subindex to develop a better understanding of the 'real' problem areas (see Table 2). A close examination of the 28 variables relating to the two areas is summarized in Table 4.

Table 4: Comparison of South Africa with leading countries when it comes to Readiness subindex and Usage subindex

Variables relating to Readiness subindex and Usage subindex	Rank of South Africa / 144	Leading country	Leading country value	SA value
3rd pillar: Infrastructure and digital content				
Electricity production, kWh/capita	45	Iceland	53,637.7	5,004.3
Mobile network coverage, % pop	40	Azerbaijan	100	99.8
Int'l Internet bandwidth, kb/s per user	66	Hong Kong	1,046.3	18.9
Secure Internet servers/million pop	54	Iceland	3,025.1	73.9
Accessibility of digital content	85	UK	6.5	4.8
4th pillar: Affordability				
Mobile cellular tariffs, PPP $/min	117	Liberia	0.0	0.51
Fixed broadband Internet tariffs, PPP $/month	89	Israel	8.11	37.48
Internet & telephony competition, 0–2 (best)	118	Argentina	2.0	1.13

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Data Source: Bilbao-Osorio et al. (2013)

Continued Table 4: Comparison of South Africa with leading countries when it comes to Readiness subindex and Usage subindex

5th pillar: Skills				
Quality of educational system	140	Switzerland	6.0	2.2
Quality of math & science education	143	Singapore	6.3	2.0
Secondary education gross enrollment rate, %	56	Australia	131.3	93.8
Adult literacy rate, %	93	Estonia	99.8	88.7
6th pillar: Individual usage				
Mobile phone subscriptions/100 pop	37	Hong Kong	214.7	126.8
Individuals using Internet, %	96	Iceland	95.0	21.0
Households w/ personal computer, %	90	Iceland	94.7	18.3
Households w/ Internet access, %	94	Korea Rep	97.2	9.8
Broadband Internet subscriptions/100 pop	96	Switzerland	40.0	1.8
Mobile broadband subscriptions/100 pop	55	Singapore	114.1	19.8
Use of virtual social networks	86	Iceland	6.6	5.3
7th pillar: Business usage				
Firm-level technology absorption	38	Sweden	6.3	5.4
Capacity for innovation	41	Japan	5.9	3.5
PCT patents, applications/million pop	42	Sweden	297.1	6.0
Business-to-business Internet use	36	Finland	6.3	5.6
Business-to-consumer Internet use	52	UK	6.3	4.8
Extent of staff training	26	Switzerland	5.6	4.6
8th pillar: Government usage				
Importance of ICTs to gov't vision	105	Singapore	5.9	3.4
Government Online Service Index, 0–1 (best)	79	Korea Rep	1.0	0.46
Gov't success in ICT promotion	100	UAE	6.1	3.9

Data Source: Bilbao-Osorio et al. (2013)

From Table 3 and Table 4, the main questions emerging are: How far is South Africa from the leaders? How can the current uptake of technology by people be improved? And what can South Africa learn from the leaders? These questions are considered in the discussion.

6.0 PRELIMINARY STUDY ON EXTENT OF E-PROCUREMENT AWARENESS AND ADOPTION IN THE SOUTH AFRICAN CONSTRUCTION SECTOR

Figure 1 show the distribution of the respondents to the online survey conducted to develop an initial idea of the extent of awareness and application of e-procurement. This was a pilot study and the preliminary findings are to be investigated in a wider study that is ongoing.

A majority of respondents (70%) are aware of the use of e-procurement in construction. On whether their organizations use e-procurement in procuring construction works, services or supply, the majority (76%) said their organizations do not use e-procurement, while 24% indicated that they use e-procurement in acquiring construction works, services or supply. The result also reveals that among the 23 respondents 15 (68%) have not participated in a

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construction project that involved the use of e-procurement systems and applications. In contrast seven representing around 32% of the respondents indicated that they have participated in construction projects that involved the use of e-procurement. These issues are being investigated further to also address issues relating to the attitudes of clients, vendors and suppliers to electronic procurement and how they think it may work.

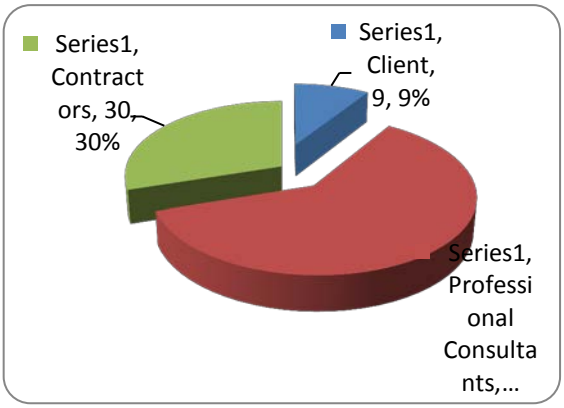

Figure 1: Distribution of Respondents in the survey

7.0 DISCUSSION

The study was conducted to examine three key issues. These are the regulatory framework and policies guiding procurement; ICT infrastructure; and technology uptake by people in construction industry in South Africa. The 19 different pieces of legislation and two policy documents that regulate procurement practices in South Africa and the GIT (2013) reports were used as the framework for analysing the regulatory and ICT environment for e-procurement adoption in South Africa. Data from a pilot survey formed the basis of evidence of e-procurement technology uptake by people in construction industry in South Africa.

Although it may be argued that any piece of legislation that regulate procurement practices will most likely have impact on e-procurement, result of the analysis of the 19 pieces of legislation found to be regulating construction procurement practices in the literature reveals that 11 of them have provisions that can facilitate or inhibit e-procurement use in the South African construction industry. It seems evident from the result that Acts such as (i) the Constitution of the Republic of South Africa Act No 108 of 1996 (ii) The Promotion of Equality and the Prevention of Unfair Discrimination Act N0 4 of 2002 (iii) Local Government: Municipal Finance Management Act, 2003 (Act No 56 of 2003)(iv) Local Government: Municipal Finance Management Act, 2003 (Act No 56 of 2003) (v) Local Government Municipal Systems Act, 2000 (Act No 32 of 2000) (vi) Construction Industry Development Board Act, 2000 (Act 38 of 2000) (vii) State Information Technology Agency

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Act 88 of 1998 (viii) Competitions Act N0. 89 of 1998 (ix) Promotion of Access to Information Act N0.2 of 2000 (x) Electronic Communications and Transactions Act (Act No. 25 of 2002) and one policy document- Government procurement: General conditions of contract July 2010 have provisions that can facilitate or act as drivers for the uptake and diffusion of e-procurement in the construction sector. On the other hand Acts like the Preferential Procurement Policy Framework Act N0 5 of 2000. Preferential Procurement Regulations, 2001; Broad-Based Black Economic Empowerment Act No. 53 of 2003 and policy documents such as the South African National Standards (SANS 294:2004) and the CIDB Standard for Uniformity in Construction Procurement have provisions that may constitute barriers to e-procurement adoption in the construction industry. It is important to mention that among the existing pieces of legislation examined, the Electronic Communications and Transactions Act No. 25 of 2002 appears to have the highest number of provisions that really support e-procurement adoption in the South African construction industry. It can be inferred from the above that ten of the existing Acts and one policy document have provisions that favours the adoption of e-procurement, while only two Acts and two policy documents have provisions that are not favourable to the adoption of e-procurement in construction. This goes to suggest that the South African procurement regulatory environment is considerably favourable for e-procurement use in the construction sector.

The content analysis of the GIT Report 2013 on the RNI scores for 144 countries, including South Africa reveals the position of South Africa in terms of here ICT infrastructure. Out of the 144 countries, South Africa is there at the middle (70th position); indicating that although her ICT infrastructure is not the best when compared with the top six countries in the e-procurement adoption, namely the USA, Japan, Sweden, Australia, the UK and Ireland, South Africa's is however among the top 49% in the world in terms of networked readiness index ranking. In fact, result of our analysis of the ranking of South Africa in the different sub-indices for measuring NRI, shows that in terms of ICT environment, South Africa is among the top 23 % in the world, meaning that the ICT environment in the country is generally sufficient in supporting the use of e-procurement systems and applications in the construction sector. However, there are areas where huge challenges exist. These are related to readiness and actual usage of the ICT infrastructure (see Table 4). It can be seen in Table 4 that there are wide gaps between the leading nations and South Africa in most of the 28 variables used in assessing readiness and usage sub-indexes in the RNI ranking as presented in the GIT Report 2013. This might help to explain the relatively low ranking of South Africa in these two areas.

On the evidence of use of e-procurement in the construction sector, result of the pilot survey shows evidence of e-procurement use in the sector. Although, the majority of respondents had neither used e-procurement systems nor participated in construction projects that involved the use of e-procurement, about one-third of the respondents have participated in a construction project that involved some form of electronic procurement. Compared to evidence from some of

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the countries summarized in Table 3, this indicates a relatively low level of e-procurement use in our industry. A set of targeted initiatives are needed to enable greater adoption of e-procurement in appropriate areas of construction procurement particularly in the area of technology uptake by people in business organisations.

8.0 CONCLUSIONS

The aim was to examine e-procurement in the South African construction industry context. To achieve this goal, the study examined the procurement regulatory, policy and ICT environment in South Africa as it related to how it can impact on the uptake of e-procurement in the construction sector. Result from the review of literature, documentary analyses and pilot survey indicates that at least ten pieces of existing legislations that regulate procurement practices in South Africa have provisions capable of facilitating the uptake of e-procurement in construction, while two of such Acts have provisions that appear to be inconsistent with e-procurement. Also, using the GIT (2013) report as a framework for assessing the ICT environment in the country, it was observed that although there are areas of challenges, the ICT infrastructure of South Africa is 49% in the world and it is comparatively good with the capacity to support e-procurement use in the construction sector. Evidence of the use of e-procurement in the construction sector was also found among the respondents in the pilot survey.

Based on evidence from this study, the following conclusions can be made. The first is that the existing procurement regulatory, policy and ICT environment in South Africa can support e-procurement adoption in the construction sector. The second conclusion is that there is indeed empirical evidence of e-procurement use in the South African construction sector. Although, this study did not investigate the extent of use of e-procurement in the South African construction industry, an attempt has been made to provide some insight into the different pieces of legislation that have implication for e-procurement use in South Africa. The paper has also helps to develop a better understanding of the ICT environment as it relates to the adoption of e-procurement; and provide empirical evidence of the use of e-procurement in buying constructions works, services and supplies in South Africa. This study implies that some aspects of the existing regulatory, policy and ICT environment constitute barriers to e-procurement uptake in the South African construction industry. There is a need to address these issues as discussed in the paper.

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LEAN CONSTRUCTION AS A SUSTAINABLE COMPETITIVE STRATEGY FOR LOCAL CONTRACTORS IN THE ZAMBIAN CONSTRUCTION INDUSTRY

Danstan Bwalya Chiponde[1] and Christine Pasquire[2]

Abstract

The construction industry is highly competitive and contracts are mainly awarded through competitive bidding, in most cases to the lowest bidder. This has lead firms to rely mostly on cost as a means of competitiveness and has been known to have shortcomings. This research therefore endeavoured to identify a sustainable competitive strategy which helps contractors grow whilst clients' needs are met by adopting lean principles in the Zambian Construction Industry (ZCI). To achieve this, primary data was collected through open ended semi-structured interviews coupled with extensive literature review. This revealed that traditional competitive strategies mainly focus on minimizing costs leaving clients unsatisfied and diminishing contractors' profit and growth, since costs are cut very low with negative profits in certain times. Competitors also shift their attention from the client to each other resulting in adversarial relationships. To overcome this, lean principles that enhance competitiveness through improved project delivery were identified. These include the Last Planner® System (LPS), Transformation, Flow, Value (TFV) theory and Target Value Design (TVD). The identified lean principles were shown to be appropriate for improving project delivery and competitiveness of local firms in the ZCI. An expected outcome of this is to enhance the local contractors' competitiveness and growth which are known to be low by adopting sustainable competitive strategies through improved project delivery by applying lean principles. It was further established that lean construction improves competitiveness by focusing on the client's value but that this is dependent on understanding lean theory and its appropriate application through relevant tools. However in the ZCI the application of lean remains a challenge because there is a lack of a clear understanding of its principles and tools.

Keywords: Lean Construction, Competition, Strategy, Sustainability, Zambia

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1.0 INTRODUCTION

The importance of construction contractors in developing countries like Zambia is undeniable since they create employment and provide infrastructure such as roads, housing and hospitals vital for the citizens' livelihood (Kululanga, 2012). With limited government resources available, value for money is essential. However, local contractors' performance and growth in the ZCI is unsatisfactory and foreign contractors have an upper hand in terms of competitiveness (Uriyo et al. 2004). The challenge therefore for the industry is to develop a sustainable competitive strategy that enables organisations meet the clients' needs and remain cost-effective in an environment where the prominent way of awarding contracts is through competitive bidding, in most cases the lowest bidder being awarded (Hampson and Kwok, 1997; Mochtar and Arditi, 2010; Latham, 1994). Consequently, firms bid low in order to be competitive and clients' needs are overlooked in the subsequent attempt to increase profit (Kim and Reinschmidt, 2006). Pasquire and Collins (1996) also argued that to achieve competitiveness, firms in the industry need to go beyond the parameters of time and cost. Further, lean has been recommended (Koskela, 1992; Womack and Jones, 1996) as a means of improving the industry's performance. Therefore, it is proposed that lean principles can enhance competitiveness and should be adopted in order to help local contractors compete and improve sustainably within the ZCI.

1.1 IMPORTANCE OF COMPETITIVENESS OF ZCI ORGANISATIONS

Zambia lies in the Southern region of Africa with one of the fastest urbanising rate. This creates a high demand for infrastructure, making the role of the construction industry vital. This can be appreciated from the sector's contribution to the GDP (an average of 11%) and the provision of employment (Muya et al. 2006). Hence Zambia's economic and social development is tied to the efficiency of the construction sector (Muya et al. 2004) and ultimately the performance of its contractors. This has also been noted by Uriyo et al. (2004) who stated;

Sustainable contracting industry implies having a cadre of contractors with the ability to participate competitively and undertake works effectively with continuous growth and performance to meet current and future needs... participation of local contractors…. (Uriyo et al. 2004. p. 9).

Essentially, for the local firms in the ZCI to survive, they need to apply competitive strategies that enhance growth through cost efficiency whilst improving their performance.

1.2 Competition in the Zambian Construction Industry

With the liberalization of the economy in the early 1990s, a number of foreign firms seized the opportunity in the provision of construction services. Consequently, major projects in the country are executed by foreign contractors because local contractors' performance is poor. This is

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attributed to their lack of competent staff, poor organisation, plant and equipment and weak financial base (Lindberg, 2009; Uriyo et al. 2004). Hence, the government has introduced the preferential procurement guidelines, giving local firms priority on government funded projects through the Zambia Public Procurement Authority (2011). However, this goal will not be achieved if the performance of local firms is not improved. This provides an opportunity to engage with lean principles to enhance the construction process with the aim of assisting the indigenous firms to become more competitive.

1.3 Definition of Lean

Worth noting is Womack and Jones (1996) who defined lean as *"…a way to do more and more with less and less – less human effort, less equipment, less time, and less space while coming closer and closer to providing customers with exactly what they want"* (Womack and Jones 1996, pp. 15). Hence, for this study, being competitive through lean is meeting client's needs with less human effort, materials and equipment. Further, lean construction attempts to take a holistic approach through the Transformation, Flow and Value (TFV) theory of production for the execution of projects (Koskela et al. 2002). Thus, to be competitive and deliver projects successfully, organisations have to ensure that their construction activities embrace value and flow as well as the transformation process which forms the current focus (Koskela, 1992).

1.3.1 What is a Strategy?

Chandler's (cited in Junnonen, 1998) definition of strategy is worth noting; *"…..the determination of the basic long-term goals and objectives of an enterprise and the adoption of courses of action and the allocation of resources necessary for carrying out these goals"* (cited in Junnonen, 1998, p. 107).Therefore a strategy must provide vital resources needed to achieve the desired goals which may include training or acquiring new technology and ideas such as lean. Consequently, a competitive strategy is taking deliberate actions to position a firm in the industry so that it is the most preferred by customers (Porter, 1980). In line with that, local contractors in the ZCI can adopt lean principles in order to become competitive as a strategy. This is based on scholars (Morrey et al. 2012; Sage et al. 2012) recommendations that a strategic approach in applying lean be adopted.

1.4 Porter's Competitive Strategies

The essence of any competitive strategy is to structure a company and its activities so that it is the most preferred over its competitors (Porter, 1980). To achieve this, organisations need to understand the driving factors of competition in their industry noted by Porter (1980) as shown in table 1. To assess the aptness of lean as a competitive strategy, table 1 further shows selected lean tools that can be used to address Porter's factors of competitiveness by a firm. Porter (1980) also advanced that an organisation can apply the following competitive strategies;

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- ***Cost Leadership***– A firm becomes superior over its competitors through cost minimization; tight cost and overhead control which offer lower prices or cost.
- ***Differentiation –*** A firm offers services that are unique or different from those being offered by other competitors through design, technology and customer relations.
- ***Focus –*** This strategy attempts to combine the above strategies by focusing towards particular clients or markets.

Table 1: Five Factors that Influence Competition (Porter, 1980 and Koskela et al. 2002.)

PORTER'S DRIVERS OF COMPETITION	LEAN PRINCIPLES TO USE	MEANS AND TOOLS
Potential Entrants -Use new technologies, resources thus increasing competition.	Build continuous improvement in the process.	Technology investment, training, improving existing processes, set targets involve all employees.
Buyers Buying Power - demands for quality services and lower prices	Increase output value by systematic customer focus, reduce variability	Knowing variable types of clients and their value and applying TVD, LPS and TFV theory
Substitutes - Alternative goods and services that perform similar functions	Continuous improvement process	Set targets for improvement, training and innovation
Suppliers - Influence competition by raising prices for the goods	Reduce cycle time by minimizing number of steps, parts and linkages	Concurrent Engineering, JIT Consolidating or integrating activities, organisational changes, partnering
Existing Competitors - Vying for available clients with peer firms	Bench marking, Build continuous improvement into the process	Knowing competitors, finding, modifying and applying best practices.

However, these strategies have limitations which have been noted by Porter (1980) summed up in table 2 below. Ercan (2012) also argues that in practice, only the cost focus is applicable in construction since differentiation of a product and branding will only be apparent after the project is completed. Overall, these strategies are presented as standalone instead of a holistic approach (Porter, 1980; 1985; Ercan, 2012).

Table 2: Limitations of Porters Competitive Strategies (Porter, 1980; 1985).

Strategy	Disadvantages/Risks
Cost Leadership	Not sustainable since competitors imitate, technology changes, inflation, shifts the focus away from customers' values.
Differentiation	Competitors imitate, basis of differentiation varies according clients.
Focus	Demand changes, can be imitated.

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The need for applying lean construction as a competitive strategy strengthens when considering Porter's (1980) factors termed as non-threatening moves when selecting a competitive strategy;

- ***Sustainable*** - Improves performance and is not matched or copied by competitors.
- ***Growth*** - Involves activities that enhance the firm's position and stimulates improvement in the competitors or industry.

Hence by applying lean as a competitive strategy, the contractor's approach will shift from a cost focus to that of the client's value, eventually increasing productivity in the whole industry through the removal of wasteful (non-value) activities instead of the current cost reduction strategy which leaves contractors with low profit and unsatisfied clients.

1.5 Application of Lean as a Sustainable Competitive Strategy

Competitiveness through lean is ensuring that projects have and are executed through required standards effectively meeting the clients' and customers' value. Costs are reduced as a result of efficient use of materials and time compression within processes and quality is enhanced by an exacting compliance with the required standards. This can be achieved by applying Lean Project Delivery System (LPDS) tools within two approaches;

1.5.1 Short Term Approach

Organisations must have a short term strategy to cover their daily activities relating to both site and office operations since successful completion of projects improves a firm's perception (Neto, 2002). The following lean approaches contribute to this:

- *Last Planner System* – Involves breaking down tasks, usually in weeks, identifying related constraints early and specific resources and personnel are assigned. After the specified duration, reasons for failure or improvement are reviewed in a meeting, which helps to reduce project variability (see Ballard, 2000 and Mossman, 2012).
- *Materials Management* – To achieve this, organisations need to apply other production concepts such as Just-In-Time (JIT) and supply chain alliances in order to reduce the waiting time and inventory (Koskela, 1992).
- *Labour Organisation* **–** By having a pool of qualified and multi-skilled personnel to respond to variability in clients' or projects' (Koskela et al. 2002) project uniqueness is reduced.
- *Lean Assembly* **–**Ensuring that little effort is used whilst expediting the process through one-touch handling, multi-skilled workforce, and preassembly (Court et al 2009). This must be coupled with Built-in Quality to prevent unnecessary cost and time overruns in correcting substandard works (see Reed, 2008)

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1.5.2 Long Term Approach

An underpinning aspect of all lean implementation and transformation (Liker 2004) a long term approach hinges on establishing lasting relationships, enabling the organisation respond to clients' needs and overcome challenges and changes that overwhelm the industry (Porter, 1985; Sage et al. 2012). The following lean principles have been recommended;

- *Strategic Partnering* – Firms can be competitive by partnering with other supply chain parties. These must be engaged early enough and benefit from their experience in planning and problem solving (Porter, 1980; Hampson and Kwok, 1997).
- *Supply Chain Differentiation*-This is by breaking down work packages yet considering the whole process by ensuring that the works are done by competent individuals or subcontractors (Porter, 1985; Koskela, 1992).
- *Collaboration* – It is important to realize that things can be done better through a team (Wilkinson 2005). Thus individual professionals and organisations must share and exchange their knowledge and experience through collaboration in order to succeed.

The above list is not exhaustive. Thus, to have a sustained competitive strategy, organisations must be able to gather and analyse local and global information relating to construction and adopt good practices. Further, competitiveness in an organisation can be attained at the pretender and post tender or construction levels (Langford and Male, 2001). However, instead of applying lean principles at the two levels, post construction must be added to allow for continuous development and factor changes occurring in the internal and external environments of an organisation (Junnonen, 1998). This is shown in Table 3 below, the emphasis being on continuous improvement in order to be competitive in the long term.

Table 3: Proposed Stages at which selected lean construction principles can be applied

Competitive Level	Competitive Focus	Lean Principles	Means And Tools
Pre-tender	Cost and time Estimate accuracy.	Reduce viability, Customer focus.	TVD, realize the variant clients, partnering
Post-tender or Construction stage	Meet multiple project objectives (Not only quality, time and cost).	-Transparency, focus on the complete process.	-Reduce moving and waiting times (JIT), multi skilled workforce, LPS.
Post Construction – Looking into the future	Repeat business and new business.	-Continuous Improvement, Benchmarking.	Innovation, training, adopt best practices etc.

Source: Langford and Male (2001) and Koskela (1992)

2.0 RESEARCH METHODS

In order to probe and assess the aptness of lean as a competitive strategy, an exploratory approach was used. Realizing that there exists little or no information in the ZCI on the use of lean construction, this method was recommended since the research delved into an unknown

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theory (Naoum, 2007; Fellows and Liu, 2008) and was further tested through qualitative data collection and interpretation of the results from the observations made.

2.1 Sample Size and Sampling Method

Convenience sampling method was adopted coupled with semi structured interviews since this allows getting in-depth insight and ideas from specific professional respondents in the area of interest (Biggam 2008 and Kumar 2011). Thus, two specific groups where identified for this research; organisations applying lean construction and those that are not. Lean construction being well developed in the UK Construction Industry compared to the ZCI, professionals applying lean construction interviewed were from the UK (3) and those not applying lean principles from the ZCI (5). Vigorous literature review was also done.

2.2 Independent and Dependent Variables

Naoum (2007) defined variables as a phenomenal that is likely to change by establishing their relationship. Thus, the following variables where identified; Lean Construction, Strategy and Competitiveness as shown in Figure 1.

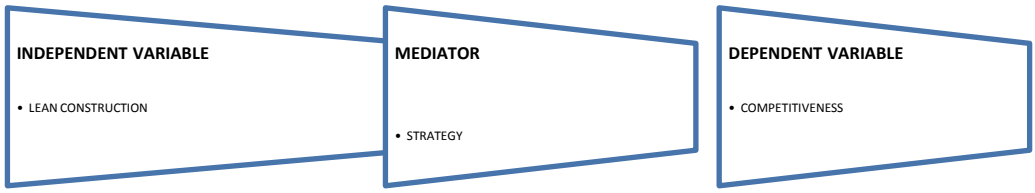

Figure 1: Research Variables (Adapted from Naoum 2007)

Hence, the research assessed how competitiveness is dependent on lean construction. The manner in which competitiveness can be influenced is through the application of lean, which is the mediator (strategy) variable (Fellows and Liu, 2011). Therefore, the construct, which is the outcome of the variables, was established to be competitive advantage.

2.3 Research Limitations

The sample size (8) is not representative. It is thus recommended that further research be done with a larger group and assess how lean can be implemented in the ZCI since the research did not establish such a framework.

2.4 Data Analysis and Discussion

Competitive Strategies Used by Local Firms

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Most (4) respondents acknowledged that the prominent competitive strategy is costing or pricing. This is achieved by adjusting the profit margin depending on the amount of the contract sum. Only 1 organisation indicated that they try to consider other competitors and stay abreast with current market trends and prices. Other strategies used were presenting bid documents presentable and following the laid down tender requirements.

Knowledge and Use of Lean in the ZCI

Of the professionals interviewed in the ZCI none (0%) apply lean and therefore lack understanding. In contrast it can also be seen from the 5 interviews conducted, that some lean principles are unconsciously in practice in the ZCI. For example, a crude form of LPS evidenced by engaging site foremen in planning activities and to a lesser degree in the use of premix concrete. Others also engaged in material management by making sure that accurate estimates of quantities are made when making orders to reduce on waste of materials. Whilst this recognises the existence of physical waste it is excludes the identification of constraints and reviews or feedback meetings. What is needed therefore is the conscious application of lean to build on its crude application.

This is important since the application of lean as a competitive strategy hinges on the depth of understanding the theory and principles. This is apparent from the 3 professionals in organisations that apply lean in the UK who all demonstrated a grounded understanding of lean thinking. This led them to applying lean principles such as LPS, preferred supply chain and collaboration.

Challenges of Being Competitive faced by Local Contractors

Importantly Mossman, (2009) recommended that focus has to be creating value for the client and end users. Hence in achieving competitiveness, firms must keep the costs low whilst increasing clients' and end users' satisfaction and value. This is important because from the professionals interviewed one major challenge highlighted was keeping costs low (being profitable) whilst increasing the client's value. Other challenges included high interest rate, poor estimating, lack of plant and competition from foreign construction firms. Poor performance of local contractors also was also highlighted.

How can Local Firms have sustainable competitiveness and growth?

All the local contractors (5) suggested that there is need to change how the construction process is handled. Changes included; not selecting bids based on the lowest bid, adopt new management approaches, focus on the client and not costs and partnering. Though lean

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principles were not mentioned as a tool for being competitive, inherent features of lean such as client focus and doing more with less can enhance the local firms' competitiveness.

3.0 Discussion

Essentially, lean focuses on eliminating waste in the production process in order to deliver the desired value. This is achieved by applying LPDS and tools such as LPS and developing a lean supply chain. Based on the findings that there is a lack of understanding of lean and it is not practiced in the ZCI, the basis of applying lean must first be through creating an increased understanding amongst construction parties; contractors, clients, designers, suppliers and manufacturers. Ultimately, every employee of an organisation must be involved from the strategic level down to the site foremen and the operatives.

Client's Value and Satisfaction		
High	**Q1 – *Sustainable Competitiveness*** through innovation, lean strategy – continuous development	**Q2 – *Unsustainable Competitiveness*** – high costs reduces clients and reduces company's returns.
Low	**Q3 –** Low competitiveness, focusing on the cost instead of customer	**Q4 –** Departure from clients' value low competitiveness, low profits, increased costs.
	High	**Low**
		Cost

Figure 2: A Sustained Competitive Strategy (Source: Author 2014)

Further, the sustainability of lean as a competitive strategy can be noticed based on its benefits which accrue to both sides of the client and the contractor; increased value with less of costs. This offers a win-win situation since quality is increased using less labour and material (Womack and Jones, 1996) unlike the price cuts which deplete the contractors' profits without meeting the clients' value.

Hence lean presents itself as a sustainable strategy compared to the traditional strategy which relies on cost cutting which results in contractors with low profits and low client satisfaction. Thus from Figure 2, firms must strive to be in Q1 where the clients' value is high with low costs, by overcoming these challenges. Q3 shows the traditional strategy where cost reduction is done without increasing or focusing on the client's value resulting in low competitiveness. With no consideration of the clients' value, firms operate in Q4 where the costs are high with low value due to repeat works, over supervision and other non-value adding activities. Firms in Q2 may satisfy the client with no sustained competitiveness since clients would prefer firms in Q1. Costs will also reduce the firm's profit. However, for firms to be in Q1, vigorous and continuous

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improvement must drive operations. Hence this research focused on how a firm can operate in Q1 by applying lean principles.

Need to Change the Approach to the Construction Process – TFV Theory

Ultimately, for firms to remain in Q1 of figure 2, they will need to apply TFV (Transformation, Flow and Value) theory. This is illustrated in figure 3 below. The emphasis on competitiveness requires that the three perspectives of TFV form the backbone of operations so that a firm operates in QA, a sustainable competitive strategy. Hence, the flow and transformation must focus on the creation of value for the client through the application of JIT, LPS, TVD (Target Value Design) (Zimina et al 2012) and strategic alliances in capturing clients' value. Ultimately, any other features or aspects that do not add value must be eliminated.

High	**QA – TFV** Sustainable Competitiveness through JIT, LPS, ECI, Continuous Engineering	**QB – T and V** Unsustainable Competitiveness with no regard for the flow
Low	**QC – F and T** Low competitiveness, Flow oriented	**QD – T** Departure from clients' value, low competitiveness,

Quality and Client Satisfaction

Low **High**

Tim/Cost

Where T=Transformation, F=Flow, V= Value

Figure 3: Competitiveness through TFV (Source; Author 2014)

Thus, from figure 3, through TFV competitiveness can be enhanced since the completion time is reduced with an increase in the project quality. Where one perspective is missing, competitiveness is lost and firms operate in QB, QC and QD – QD reflecting the most common performance in traditional construction practice by local contractors.

4. CONCLUSION

The essence of competition in any industry is to encourage improvement in the services offered by competing parties notes Porter (1980; 1985). However, for the ZCI, this remains far from realization due to the reliance on cost based strategies which reduce organisations' returns and leaves clients unsatisfied. As such a shift from the cost to a sustainable approach, value and client based strategy is required. The focus for any competitive strategy therefore must be meeting the client's value without diminishing an organisation's profit for local firms to thrive amidst the increased international competition. This can be achieved by adopting a lean approach which focuses on ensuring that variability is reduced on projects through waste

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reduction. To help this, project variability can be reduced through the use of LPS, strategic alliances and lean principles to aid competitiveness. Further, the estimation process can become more holistic by taking cognisance of factors that affect the flow and value of a project rather than the transformation alone. Thus, when preparing designs, budgets and estimates, TFV theory and TVD principles should be incorporated enhanced by collaboration. Further, Instead of the predominant traditional competitive tendering which is associated with many failures the industry must investigate other procurement avenues such as Integrated Project Delivery and Lean Project Delivery Systems. It is thus concluded that lean construction is a sustainable competitive strategy and should be adopted because its principles encourage giving clients more with less of human, plant and material input. However a major challenge still remains since the understanding and application of lean principles in the ZCI is lacking. Hence it is recommended that for the full benefits of having a sustainable competitive strategy through lean, the awareness and understanding of lean construction principles must be increased amongst all the parties involved in the construction process.

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DEVELOPMENT OF A FRAMEWORK FOR TECHNOLOGY TRANSFER PARTNERSHIPS IN THE GHANAIAN CONSTRUCTION INDUSTRY: A LITERATURE ANALYSIS

Owusu-Manu De-Graft[1], and Antwi-Afari Maxwell Fordjour[2]

Abstract

Technology transfer (TT) is the process of transferring knowledge and technology from one country to another. International Technology Transfer (ITT) projects have emerged as an important business and managerial concern to many developing countries across the globe as well as Ghana. These technology transfer projects could be viewed in the form of knowledge (soft technology), skill, and tools (hard technology) which usually congregate from advanced countries to the developing countries through construction project development to enhance the local technology capabilities in response to a changing economic environment. Numerous types, modes (known as channels) of TT could occur from the public and private firms of advanced countries to private and public sector locally.

This paper aims to elucidate theoretically the problematic dealing with the types, modes and propose a conceptual framework for a successful ITT projects to development of technological capabilities for the Ghanaian construction industry. The analysis is largely based on a synthesis of the literature augmented by the authors' experiences and continuing involvement in the field. The formalization of the paradox and development of the conceptual model opens opportunities for a new research agenda in the future, which is highlighted as part of the study. This review could shed dynamic ideas for future researchers to further identify, conceptualize and understand the underlying theories and perspectives which strongly influence the previous, current and future concept of technology transfer.

Keywords: Technology Transfer, International Technology Transfer, Knowledge, Absorptive Capacity, Ghana.

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3.4 INTRODUCTION

The dynamic nature of technology has contributed to the existence of various definitions and concepts of technology by the previous studies which are related to technology transfer. These discussions on the concepts of technology are crucial in getting a clear understanding of the nature of technology and examining what the technology consists of. The term 'technology' is inherently abstract concept which is difficult to interpret, observe and evaluate (Blomstrom & Kokko, 1998). Regardless of the extensive research done on this subject, many of the literatures are fragmented along different fields and generally there is no commonly accepted paradigm (Reddy & Zhoa, 1990). Lan & Young (1996) argue that technology definition is varied according to authors and context of disciplines. Because of this the concepts, variables and measures relevant to the study are different from one study to another (Kumar et al., 1999). Past studies have shown that defining the concept of technology is not easy (Reddy & Zhoa, 1990); therefore technology has been defined from different perspectives. Existing studies on TT and ITT have attracted researchers from cross-section of disciplines including organizational management, political science, economics, sociology, anthropology, marketing, construction and recently management of technology (Cusumano & Elenkov, 1994; Zhoa & Reisman, 1992). Even though TT is not a new business phenomenon, the considerable literature on technology transfer that has emerged over the years agrees that defining TT is difficult due to the complexity of the technology transfer process (Robinson, 1988; Spivey et al., 1997). The definitions depend on how the user defines technology and in what context (Bozeman, 2000; Chen, 1996).

2.0 TECHNOLOGY COMPONENTS

Technology consists of three interdependent, co-determined and equally important components: hardware – the physical structure and logical layout of the equipment or machinery that is to be used to carry out the required tasks; software – the knowledge of how to use the hardware in order to carry out the required tasks; and brain ware – the reasons for using the technology in a particular way (Zeleny 1986). Bhalla (1987) defines technology as consistent of three elements: the physical things – tools, machines and materials that mankind uses for all activities; the software aspects including technical processes design and procedures such as heat treating sequences, computer programs, etc.; and information systems that describe the foregoing such as standards for different motor oil, standards for heat exchanger insulation, and standards for screw threads. A further extension of the understanding of technology components is given by Sharif, (1994a), Ramanathan (1994), Sharif and Ramanathan (1995). They state that technology consists of four interrelated and interacting components which are (1) object-embodied form or "Techno ware"; (2) human-embodied form or "Human ware"; (3) document or record-embodied form or "Info ware"; and (4) institution-embodied form or "Orgaware". This

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engineering approach is considered useful in this study in relation the transfer of any technology.

3.4 Techno ware:

Techno ware is object embodied physical facilities. It comprises a material transformation subsystem and an information processing subsystem. The material transformation subsystem performs desired mechanical operations that the techno ware has been designed to perform. Techno ware amplifies human powers and controls for transformation operations. In a business enterprise, techno ware changes through a process of periodic substitution of old by new. In general, the degree of techno ware sophistication corresponds to the increasing complexity of the physical facilities for transformation operations and other functions such as scale of operations, interrelationships among operations, types of conversions, energy requirements, quality of outputs, safety and environmental soundness of operations etc.

For example, an information-processing subsystem carries out a three stage control sequence namely, sensing-analysis-actuation. The information processing subsystem may be completely or partially built into the techno ware. There are considerable interactions between the techno ware, the human ware that operates the techno ware, and the info ware needed to operate the techno ware.

2.2 Human ware:

Human ware is the person embodied human abilities. It consists of skills, craftsmanship, expertise, and creativity. It is needed to realize the potential of techno ware and consists of “contact human ware” and “support human ware”. Without relevant human ware, the techno ware is simply useless. Human ware changes through a process of progressive learning of new things. Usually the degree of human ware sophistication indicates the increasing level of competence of all individuals engaged by the organization. The competencies are in terms of skill level (derived from general education and specific training), appropriateness of training, achievement orientation, extent of relevant experience, productivity orientation, creativity potential and the motivation of the personnel (Sharif, 1994a). Human ware sophistication is important to understand the technology properly and utilize in proper need. It includes ability to comprehend and use work-specific technology components, ability to mobilize setup and utilize technology components for work, ability to optimize use of available technology components for all tasks.

It is human ware that, through its insights of the functional capabilities, limitations and extent of manipulability of the techno ware, causes desired outputs to be produced by the techno ware. The importance of human ware is well elaborated by Ozaki (1991) who points out that the humanistic economic philosophy of Japan is based on three propositions: human resources are

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the most important element of production. They are the ultimate origin of the market value of all goods produced.

Human ware sophistication depends not only on formal technical training related to the operation of techno ware but also involves: the attitude of the individual towards work, workplace and fellow workers (Ramanathan, 1994). This comes about due to the cumulative effects of the collaboration between individuals making up a team, and applying, during a long period and in the same conditions, a certain process that they themselves have refined. Such know-how generation requires appropriate attitudes in the human ware.

Thus, the sophistication of both the contact and the support human ware would depend on the academic qualifications, experience and training including their attitude towards their work, workplace and fellow workers.

2.3 Info ware:

Info ware is record embodied documented knowledge. These are facts and formulae, design parameters, specifications, manuals, theories etc. It represents the accumulated knowledge needed to realize the full potential of the techno ware, human ware and orgaware. Info ware enables quicker learning and savings in terms of time and resources. It changes through a process of cumulative acquisition of knowledge. Normally the degree of info ware sophistication represents the increasing utility of an up-to-date knowledge base acquired for various enterprise functions. Sharif (1994a) describes the utility as nature and type of knowledge (relevance, timeliness and reliability of facts and figures), ease of retrieval of stored knowledge, extent of networking for updating, etc. The degree of info ware sophistication includes documented knowledge that provides awareness regarding technology components, manuals for the operation and maintenance of physical facilities, availability of facts and figures for acquisition and optimal performance, and access to the latest theories of techno ware, human ware and info ware and state-of-art knowledge for innovation.

2.4 Orgaware:

Orgaware is institution embodied organizational frameworks. They are methods, techniques, organizational networks, and management practices. It basically helps for the coordination of activities and for resources utilization towards achieving desired goals. Orgaware sophistication is needed for additional increase of value, an increase of new management techniques, methods and relationships for the market competitiveness and self-reliance of the enterprise. Orgaware sophistication includes tradition based work organization techniques and methods, education and experience based work facilitation techniques, systems analysis and operations research based optimization techniques and information technology based re-engineering and innovation techniques, and community based indigenous knowledge. It includes all the tacit knowledge embedded in the organization. The critical need for the development of appropriate

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orgaware to make the best use of advanced techno ware and meet the challenges of dynamic market conditions has been the theme behind many authors such as those by Jaikumar (1986), Hayes and Jaikumar (1988), Cusumano (1988), Kanter (1989), Schmenner (1988) and Hill (1992).

It should be emphasized that the four components of technology – techno ware, human ware, orgaware and info ware are interrelated and influence each other. They are required simultaneously in any system of production that is important to be transferred. Absence of any of the four components means no transformation in the process and thus an ineffective system. While the human ware is the center of all these activities, the orgaware is the environment that allows for all components to come together. The info ware can facilitate the process or its lack can slow it down.

3.0 CHANNELS OF TECHNOLOGY TRANSFER

International technology transfer may be classified into three main types, according to the characteristics of the business relationship between the source and the recipient. The three types are 1) 'arms'-length trade of technology, 2) intra-firm technology transfer, and 3) inter-firm technology transfer (Capannelli, 1997). However, the literature has thus far paid greater attention to the first two channels, since they are considered to be important means of upgrading the technological capabilities of developing countries (Reddy and Zhao, 1990).

Technology can be transferred in two major forms, namely intra- and inter-firm technology transfers. From previous studies (Cohen and Levinthal, 1990; and Techakanont and Terdudomtham, 2004), technology transfer is recognized as being complete only if a transferee is able to understand, operate, and make effective use of technologies that have been transferred. However, how fast and successful a transferee is in internalizing transferred technology or knowledge and making it his own (absorptive capacity) depends on prior relevant knowledge (Cohen and Levinthal, 1990).

'Arms' length trade of technology refers to cases in which technology is acquired through market-mediated channels, and the recipient must pay for technology by, for example, paying technological fees or royalties or simply paying the monetary value of the machine in question. Intra-firm technology transfer refers to cases in which foreign firms supply the necessary information and train local workers in their overseas affiliates or joint ventures. Foreign firms, who own the technology, receive dividends as the return on their transfer of the technology. With respect to the forms of technology transfer, previous studies have used slightly different terms to define them.

Inter-firm technology transfer is defined as technology transfer between large, foreign and smaller, local-based firms in the manufacturing sector. It has long been recognized that informal technology transfer occurring through this non-market-mediated route provides opportunities for

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local parts suppliers to learn new technology from foreign finished-product assemblers (e.g., Lall, 1980; Mead, 1984; Hill, 1985; Wong, 1991 and Capannelli, 1997). Wong (1991) divided forms of inter-firm technology transfer into two types, direct and indirect. These writers all found that direct assistance, forms of which have included training local suppliers employees, giving advice about quality control or management practices, performing plant audits and troubleshooting some production problems, or loaning equipment, had not been frequently observed. However, Wong (1992, p. 53) has noted that the importance of technology transfer through "inter-firm" linkages such as spillover, learning facilitation, and investment inducement are more important. Moreover, there is significant evidence that confirms that local parts suppliers have improved their technological capabilities through inter-firm technical linkages, even in cases in which they have not received direct assistance (e.g., Capannelli, 1997; Techakanont, 1997; 2002).

4.0 TECHNOLOGY TRANSFER MODELS

Many researchers have studied the TT process and a number of international TT models have been developed. However, whilst many of these models were developed for the business and manufacturing sectors, there are common concepts and factors that they all share. This study has reviewed various TT models that have been proposed over the last two decades. Five noteworthy models have been chosen, which incorporate concepts and factors related to the proposed model in this research.

The first model discussed (Calantone et al. 1990) developed a comparative marketing framework for international TT based on concepts formulated by Boddewyns' comparative marketing research (Boddewyn, 1966; Boddewyn, 1981). This framework presents a system made up of five elements that describe the TT process. The framework describes the relationship between the elements as well as the macro factors which make up the elements. The second model (Simkoko, 1992) emphasises technology acquisition, which is considered a backbone for the main target of the overall TT process. The case study of this model considers the TT process between Sweden (as a developed country) and developing countries such as Tanzania and Kenya. This model was chosen for this study because of the similarities between Sweden and Finland in terms of the experience of Swedish construction companies in TT projects in developing countries. The third model (Saad, 2002), for which the case study country was Algeria, emphasises extending the traditional project life cycle model to involve TT stages. This model was chosen because of the similarities between Algeria and Iraq in terms of culture, environment, national mentality, and educational level. Moreover, policy, economic and governmental structures were equivalent in both countries. The fourth model (Wang et al., 2004) model was developed from semi-structured interviews with 62 multinational companies operating in China. Archives and publications on the firms operations were also examined in the model development and validation stages. The model also made distinctions between the transfer of tacit and explicit knowledge. Finally, the fifth model (Waroonkun, 2007) is the value-added model, in which the focus is on the ultimate performance of local

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staff when they work independently. Modelling will be developed through a process of justifying, grouping, preferring and refining factors established across the above-mentioned researchers‟ models. Table 1.1 highlights the reasons behind choosing these five research models and the justification of these choices.

Table 1.1: The five TT research models and the justification of choosing these models in this study

No	Model Name	Acronyms	Author	Year	Justification of Choice
1	Comparative Marketing Framework	CM	Calantone et al.	1990	There were several important factors that have been identified that were adopted from this framework to produce the conceptual model for international TT in construction projects. In particular, this study adds value by introducing the concept that international TT is a dynamic iterative process. Moreover, the five-element system is effective in describing the general constructs that make up the international TT phenomenon.
2	Technology Acquisition Model	TA	Simkoko	1992	There were 12 countries chosen from Africa, South America and Asia. This variety would enrich the research resources considering the different cultural and language issues as well as the geographical distribution between transferor and transferee. The other remarkable characteristic of this model is the focus on knowledge acquisition.
3	Extended TT Project Life Cycle Model	ETT-PLC	Saad	2002	Due to the similarity of the state regime (totalitarian) of both Iraq and Algeria back then, further both countries share the same culture and language. The TT was in general industry. The remarkable characteristic of this model is the focus on extending the project life cycle by operating the project by local staff who have gained skills whilst their involvement with the foreign staff during the project implementation.
4	Knowledge Transfer Model	KT	Wang et. al	2004	The model developed in this study identified two stages in the transfer process. The first stage is focused on the parent's contribution of knowledge and the second stage on the subsidiary's acquisition of knowledge. Factors affecting the extent of knowledge contributed by the parent are categorized into two groups: • Parents capacity to transfer: • Parents willingness to transfer
5	Value-Added Model	VA	Waroonkun	2007	The remarkable characteristic of this model is the measure of the value-added after the project implementation phase is done. This measure is scaled by how qualified the local

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					staff are to perform similar projects in the future.

6.0 PROPOSE RESEARCH FRAMEWORK

Figure 1 proposes a conceptual framework for a successful technology transfer partnership (TTP) and development of technological capabilities in Ghanaian Construction Industry. This has been developed based on a preliminary literature review undertaken on technology transfer processes. The conceptual framework consists of three major components; the types of technology (knowledge, skills and tools), the channels, and the benefits of ITT projects.

The process of technology transfer to developing countries, such as Ghana involves a complex series of stages. The first stage refers to the flow of technology transfer in the form of knowledge (soft technology), skills and tools (hard technology) which usually congregate from advanced country to the developing countries. Knowledge transfer is about getting the right knowledge to the right people at the right time (Li-Hua, 2004). The knowledge is transferred perhaps when foreign and local managers have intimate interaction while working together. There are two major elements of knowledge namely: explicit knowledge and tacit knowledge. The explicit knowledge is transferred through formal means, such as conferences, meetings, seminars, and training sessions. Tacit knowledge on the other hand, is transferred in an informal manner, during job training sessions, telephonic communications, and other social occasions.

The tools of technology transfer could be referred as machine, electrical or mechanical component, a chemical process, software code, a patent and a technique. According to Bennett and Zhao (2004) the tools transfer could be benefited to developing countries in the form of generating greater revenues. Moreover, technology may be transferred between persons, between organizations, between regions and countries. Technology transfer occurs because of the existence seller (transferor) and buyers (transferee). Technology transfer normally refers to formal and direct arrangements between a transferee and a transferor or non-commercial arrangements between donor and recipient. This form of transfer in particular, may well be a two way process between transferor and transferee. Transferor and transferee play a major role in which, the transferor willing to transfer the technology and the transferee willing to learn the technology, hence encourages the technology transfer process.

The second stage refers to the different channels or modes of technology transfer which includes; direct, indirect, commercial and non-commercial channels (Cohen, 2004; Li-hua, 2004).The direct channels could be regarded as managerial and institutional comprising of operating international cooperation, licensing agreements, hiring expert and contractor, and training of technical staff to abroad. The indirect channels are the purchase machinery, exchange information at international meetings and attend exhibitions and trade fairs. The commercial technology transfer channels are described as foreign direct investment (FDI), joint

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venture (JVs), licensing, franchising, marketing contracts, technical service contracts, turnkey contracts and international subcontracting. Non-commercial technology transfer however, includes the review of technical publications (journals and books) and the training of foreign students (Benedetto et al. 2003). In short, firms from developing countries can accelerate the speed by which they can produce globally competitive products through rapid technology transfer from developed nations.

The final stage is the benefit of technology transfer. Benefits are perceived in the form of improving project efficiency, effectiveness, increased profits strategic goal, user satisfaction, social & environmental impacts, personal development, professional learning, profit, minimized production problems and economy impact to surrounding community (Roger, 1962).

Given the above, the framework of TTP projects in Ghana should comprises the five areas of concerned. These are: types of technology, the channels, stakeholders, barriers and benefits of TTP projects. More extensive empirical research works on these five areas are needed to refine for the future findings.

6.0 CONCLUSION

This research paper endeavour to investigate International Technology Transfer (ITT) and development of technological capabilities in Ghanaian Constructions Industry which reinforces the issues of types of technology transfer (knowledge, skill and tool), channels of technology transfer, technology capabilities, the involvement of stakeholders, the benefits and barriers that could emerged in ITT. The outcomes of the study could provide an insight in Ghanaian construction project development and will hopefully provide valuable guidelines, especially to public or private sectors in Ghana with regards to ITT.

The research presented in this paper is part of an ongoing MPhil research at Department of Building Technology, KNUST-Ghana, to develop a conceptual framework of technology transfer Partnerships (TTP) and development of technological capabilities in Ghanaian construction industry. The result of the study could provide an insight into the Ghanaian construction project development and will hopefully provide valuable guidelines, especially to public or private sectors in Ghana.

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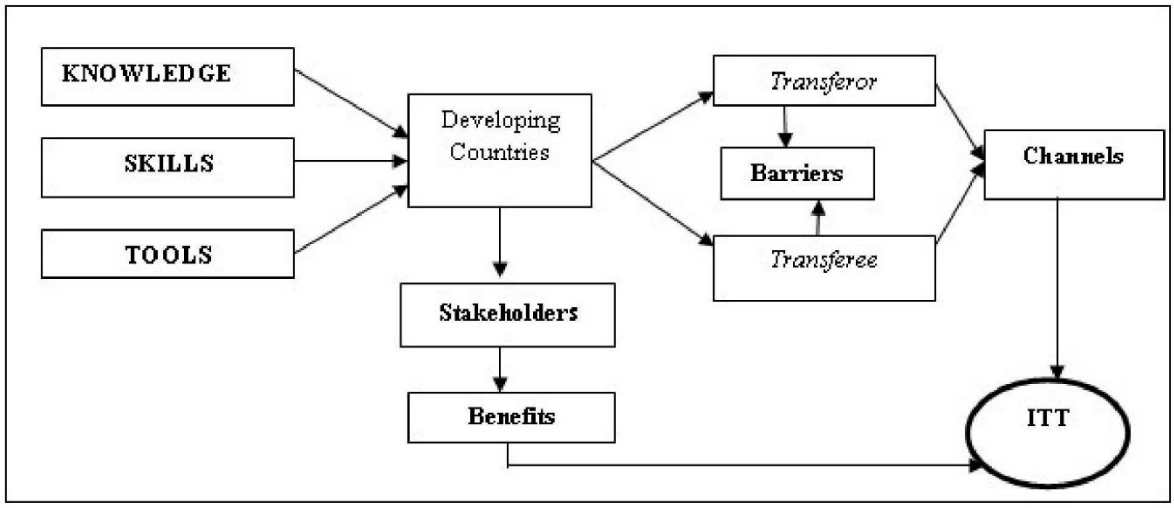

Figure 1: *Proposed a Conceptual Framework for ITT projects in Ghana*

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6

SUSTAINABILITY

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Sustainable Business Development and the Integration of Economic, Environmental and Social Sustainability Issues into Corporate Strategies

Abimbola Windapo[1] and Luqman Oyewobi[2]

Abstract

This paper examines the corporate strategies frequently used within high performing construction companies in South Africa. It investigates whether these business strategies incorporate economic, environmental and social sustainability goals. The rationale for the study is based on scholars' view that business sustainability entails the incorporation of sustainable development objectives into a company's operational strategies. However, it is not known whether high performing construction companies in South Africa incorporate sustainable development objectives into their corporate strategies. A comprehensive literature review and desk study research of the profile of randomly selected high performing contractors listed in Grade 9 on the Construction Industry Development Board (cidb) Register of Contractors and on the Johannesburg Stock Exchange (JSE) was undertaken. This study reveals the corporate strategies used within this cohort of construction companies include high levels of sustainable development objectives. The research findings suggest that the corporate sustainability strategies common amongst high performing construction companies contain elements of economic, environmental and social sustainability goals with a focus on investment in internal human resources and "green" construction processes. Based on these findings, the paper concludes that the performance of high net worth construction companies in South Africa may be connected to their focus on the triple bottom line and the sustainable strategies delineated are relevant to the African business environment.

Keywords: Business development, Construction, Strategy, Sustainability, South Africa.

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1.0 INTRODUCTION

This paper examines the corporate strategies frequently used within large, high performing construction companies in South Africa. It explores whether these strategies incorporate economic, environmental and social sustainability goals. According to Dyllick and Hockerts (2002), at the business level sustainability is often equated with eco-efficiency, which misses several important criteria that firms have to satisfy if they want to become truly sustainable. Corporate sustainability can be defined as adopting business strategies that meets the needs of a firms direct and indirect stakeholders such as shareholders, clients, pressure groups, communities and so forth today, without compromising the firms' ability to meet the needs of future stakeholders as well by protecting, sustaining and enhancing the available human and natural resources (Dyllick and Hockerts, 2002; Deloitte and Touche, 1992). The green and sustainable trend has manifested in pressures from consumers, shareholders, employees, partners and government through regulations on companies to embrace more sustainable and green practices (Holliday, Schmidheiny and Watts, 2002).

Furthermore, there has been increased pressure to broaden the accountability of companies (and industry as a whole) beyond economic performance for shareholders, to sustainability performance for all stakeholders (Visser, 2002). According to Labuschagne et al. (2005), companies that compete globally are increasingly required to commit to and report on the overall sustainability performances of their operational initiatives. Scholars view that business sustainability entails the incorporation of the goals of sustainable development namely social equity, economic efficiency and environmental performance into a company's operational practices (Labuschangne, Brent and van Erck, 2005). According to Hockerts (1999), optimal decisions can only be made when economic, social and environmental consequences are taken into consideration. Towards this goal, firms have to maintain and grow their economic, social and environmental capital base, while contributing to sustainability in the political domain (Dyllick and Hockerts, 2002). A sustainable business can therefore be said to be an enterprise that has no negative impact on the global or local environment, community, society or economy – a business that strives to meet the triple bottom line of environmental, social and economic capital.

There is however a dearth of literature on the overall business sustainability of global high performing South African construction companies and whether they effectively address all aspects of sustainability at the operational and corporate level. This paper intends to fill this gap in knowledge by examining the corporate strategies frequently used by high performing construction companies in South Africa and whether these strategies incorporate economic, environmental and social sustainability objectives. This study is of importance because there is a need for construction companies in Africa to be sustainable so that the skills, capabilities and knowledge developed within these organisations would not be lost to future generations and also that these companies would carry out their operations profitably in ways which would impact on the growth and development of the African economy, provide employment including

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social stability and reduce environmental impact. In addition, there is a need to develop a comprehensive framework of sustainability criteria that focus on operational practices in the construction sector and which can be used in assessing the sustainability performances of highly rated construction companies.

2.0 FACTORS DETERMINING CORPORATE SUSTAINABILITY

Literature and published studies (Hockerts, 1999; Dyllick and Hockerts, 2002; Labuschagne, et al., 2005; and Silvius and Schipper, 2010) categorize the determinants of corporate sustainability into three dimensions – namely Economic, Environmental and Social. See Figure 1.

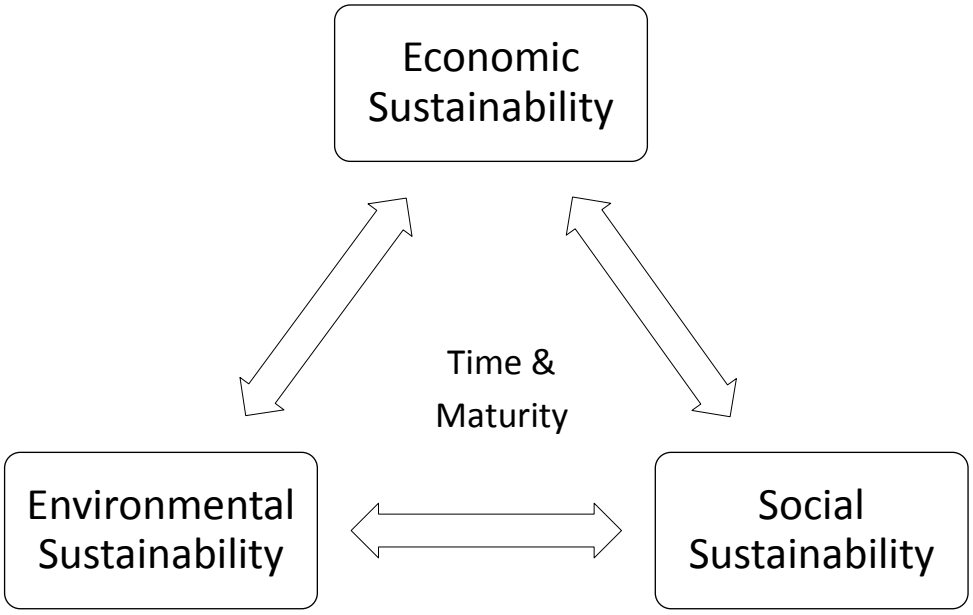

Figure 2: *Three Dimensions of Sustainability (After Hockerts, 1999; Dyllick and Hockerts, 2002; Labuschagne, et al., 2005; and Silvius and Schipper, 2010)*

According to Dyllick and Hockerts (2002) a single-minded focus on economic sustainability can succeed in the short run; however, in the long run, sustainability requires that all three dimensions be satisfied simultaneously. That is, in order to achieve long term sustainability, businesses would have to manage not only their economic capital, but also, their natural/environmental capital and social capital. The most important departure of the sustainability concept from orthodox management theory lies in its realization that economic sustainability alone is no sufficient condition for overall sustainability of a business (Gladwin, Kennelly and Krause, 1995). The time and maturity angle is added because of the view that corporate entities need to survive in order to be classified as sustainable and this can only be captured with the construct of time.

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3.0 CRITERIA FOR ASSESSING THE TYPES OF CAPITAL WITHIN THE TRIPLE BOTTOM LINE OF CORPORATE SUSTAINABILITY

According to Dyllick and Hockerts (2002), corporate sustainability implies a much broader interpretation of the concept of capital than is used either normally by economists or ecologists. Three capitals – Economic, Social and Environmental – have different properties and therefore require different approaches. Therefore, In order to measure a company's level of economic, social and environmental sustainability practices, it is pertinent to establish the measures used in their assessment as shown in Figure 2.

3.1 Economic Sustainability Criteria

According to Dyllick and Hockerts (2002), economically sustainable companies guarantee at any time cash flow sufficient to ensure liquidity, while producing a persistent above average return to their shareholders. A business must at all times maintain its own economic health and viability. Companies survive on the long term through their ability to be profitable, unviable businesses can make no contribution to the economic systems on a local, national or global level (Bickham, 2002). Dyllick and Hockerts (2002) aver that a company ceases to exist when no more economic capital is left, but that in reality, a company would become unsustainable long before. The measures of economic sustainability suggested by Labuschagne and van Erck, (2005) are as follows:

3.1.1 Financial Health

The criterion entails those aspects assessing the internal financial stability of a company and includes financial sub-criteria such as profitability, liquidity and solvency. The requirement to maintain the capital basis is commonplace in the business realm. It is broadly accepted as a precondition of successful and responsible management.

3.1.2 Economic Performance

The company's value as perceived by shareholders, top management, and government. Includes sub-criteria such as market share, profitability, return on investment, contribution to gross domestic product (GDP), market share performance and so forth.

3.1.3 Potential Financial Benefits

Under this criterion, financial benefits other than profits are assessed. For example national and/or international subsidies based on environmental, social, and technological improvements due to business initiatives – projects that are potentially eligible for clean development mechanism (CDM) funding under Kyoto Protocol.

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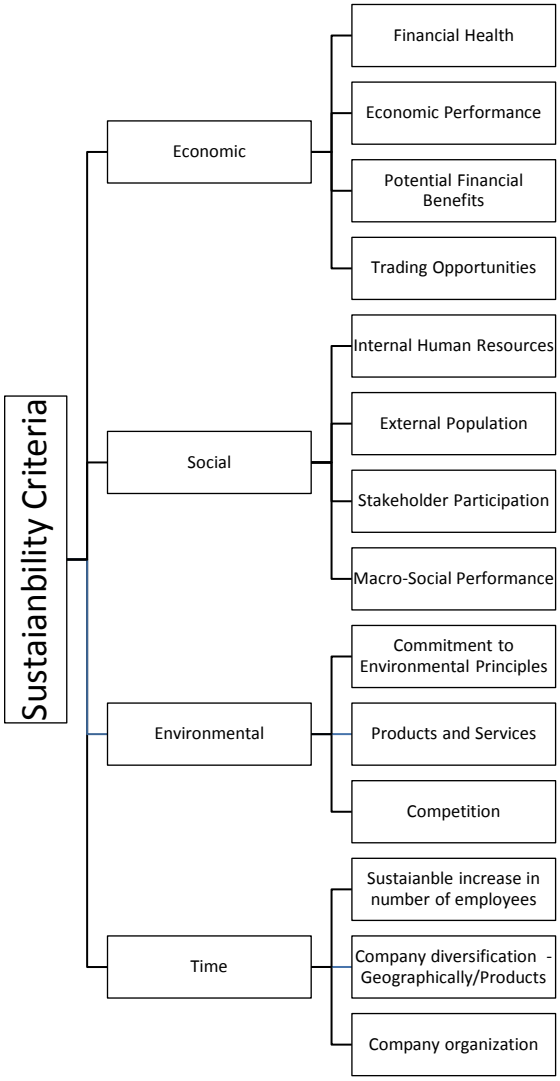

Figure 3: *Criteria for measuring dimensions of Economic, Social and Environmental Sustainability and Time (After Labuschagne, Brent, van Erck, 2005; Dyllick and Hockerts, 2002; and Silvius and Schipper, 2010)*

3.1.4 Trading Opportunities

The criterion assesses the vulnerability of the company's trade network as well as the risks it is exposed to by the network it is embedded in. It is assessed by considering the number of national and international companies in the subject company's trade network.

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3.2 Social Sustainability Criteria

Businesses are increasingly paying more attention to the social dimension of sustainable development, mainly due to an unexpected shift in stakeholder pressures from environmental - to social-related concerns (Holliday, Schmidheiny and Watts, 2002). Organizations that give back to the community, whether through employees volunteering their time or charitable donations are often considered to be socially sustainable. In order for a business to be truly sustainable, it should sustain not only the necessary environmental resources, but also its social resources including employees, customers (the community), and its reputation. Socially sustainable companies add value to the communities within which they operate by increasing the human capital of individual partners as well as furthering the societal capital of these communities (Dyllick and Hockerts, 2002). The companies manage social capital in such a way that stakeholders can understand their motives and can broadly agree with the company's value system.

According to Dyllick and Hockerts (2002) there are two different types of social capital: human capital and societal capital. Human capital is concerned primarily with aspects such as skills, motivation and loyalty of employees and business partners, while societal capital on the other hand includes the quality of public services such as a good educational system, infrastructure or a culture supportive of entrepreneurship. Since the aim of the framework is to evaluate the sustainability performances of operational initiatives, the social dimension of the proposed framework is concerned with the company's impacts on the social systems in which it operates, as well as the company's relationship with its various stakeholders. Littig and Griebler (2005) view that social sustainability is given, if work within a society and the related institutional arrangements – satisfy an extended set of human needs; and are shaped in a way that nature and its reproductive capabilities are presented over a period of time and the normative claims of social justice, human dignity and participation are fulfilled – this view is fitted more to a society. The following criteria for measuring social sustainability focusing more on the corporate institution as proposed by Labuschangne, et al. (2005) are used in the study:

3.2.1 Internal Human Resources

This focuses on the company's social responsibility towards its workforce and consists of four sub-criteria namely - Employment Stability: impact of work opportunities and fairness of compensation; Employment practices: Gender and racial equity, instituted disciplinary processes; Health and Safety: Provision and welfare; Capacity Development: Research and Development, Career development and training.

3.2.2 External Population

The impact of the company's operation on the community in which it operates i.e., communities within the close vicinity of any company's operations. The criterion consists of the following

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three sub-criteria: Human capital: employment, education and health care; Productive capital: housing service infrastructure – water and electricity, sewage and waste services, roads etc.; Community capital: effect of an operational initiative on the social and institutional relationships and networks of trust, reciprocity.

3.2.3 Stakeholder Participation

This measures the relationship between a company and its internal and external stakeholders. The criterion is divided into two sub-criteria, namely: Information provision: the quality and quantity of information shared with stakeholders are measured; Stakeholder influence: Stakeholders participation is said to have really succeeded if the stakeholder's opinion is known throughout the company. Stakeholders are empowered through information distribution.

3.2.4 Macro-Social Performance

This measures the impact of the company operations on the economic and environmental systems of the region or nation in which it is based. The criterion is divided into two sub-criteria, namely: Socio-economic performance: external economic impacts of the company's business initiatives – GDP, taxes etc. and trading opportunities; and Socio-environmental performance: which considers the contribution of the company's operational initiative to the improvement of the environment for the society or a community at regional and national levels.

3.3 Environmental Sustainability

According to Dunmade (2002), concern for the environment is fast becoming part of our culture with reports of increasing environmental problems, such as the greenhouse effect, depletion of the ozone layer, acidification, landscape degradation, eutrophication, winter and summer smog among others. A major initiative of sustainable businesses is to eliminate or decrease the impact made on the environment by their processes for example the act of going paperless, conserving materials through re-manufacturing, converting harmful gasses into clean energy, generating greener power, and improving fuel economy (Hart, 2008). Sustainable businesses also look at inputs to determine what processes are harmful to the environment and try to find green alternatives that can function at the same or better level and preferably at a lower cost (Schmidheiny, 1992; DeSimone and Popoff, 2000). According to Dyllick and Hockerts (2002) ecologically sustainable companies use only natural resources that are consumed at a rate below the natural reproduction, or at a rate below the development of substitutes; they do not cause emissions that accumulate in the environment at a rate beyond the capacity of the natural system to absorb and assimilate these emissions; and do not engage in activity that degrades the ecosystem. The criteria for measuring environmental sustainability used in the study are as follows:

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3.3.1 Commitment to Environmental Principles

This criterion assesses the company's commitment to environmental principles in its business operations: contribution to regional air quality; impacts on the quality and quantity of water, land resources, land-usage and transformation; and level of contribution to the depletion of non-renewable mineral and energy resources (Gupta, 1995).

3.3.2 Products and Services

This measures the ability of the company to supply environmentally friendly products or services that replaces demand for non-green products and/or services (Menon and Menon, 1997).

3.3.3 Competitiveness

This demonstrates that the company is greener than the traditional competition (Gupta, 1995).

3.4 Time Related Sustainability

This shows that the company has grown sustainably over time. This can be measured through the development and maintenance of a strong and committed workforce; company diversification geographically across at least two different locations and differentiation into more than one service and/or product area. That a company has grown sustainably overtime can also be demonstrated by the fact that leadership of the company spans across two steps of command/hierarchy, subordinates are given responsibility and authority to take decisions and the fact that opportunities are available via a growth path for employees to achieve their goals and aspirations in the company.

4.0 RESEARCH METHODS

The study sought to find out whether the business strategies published by high performing publicly listed construction companies on the Johannesburg Stock Exchange and also listed in Grade 9 on the cidb Contractors register incorporate economic, environmental and social sustainability principles. The study examines whether these strategies demonstrate that the large construction businesses strive to meet the triple bottom line of environmental, social and economic capital. Desk study research of five randomly selected high performing publicly listed construction companies on the Johannesburg Stock Exchange and also listed in Grade 9 on the cidb Contractors register was undertaken. Desk research entails using data collected for different purposes, possibly analysing it in other ways to produce fresh understanding (Fellows and Liu, 2008). The limitations of this approach may be as a result of the way data was collected. The sustainability criteria were assessed based on statements outlined in the companies profiles on a 3-point Likert scale where 3 = high (explicitly stated); 2 = average

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(implied) and 1 = poor (not stated/available). The data obtained were analysed descriptively in both tables and words.

5.0 RESULTS AND DISCUSSIONS

Table 1 presents the data collected on Economic, Social and Environmental sustainability criteria for five major high performing publically listed construction companies in South Africa.

Table 1 shows that generally, all the companies have explicitly outlined their economic, social and environmental sustainability objectives in their company profile (at an average rating of 2.6 on a 3.0 scale). In addition, it shows that the companies laid more emphasis on their environmental sustainability objectives than on their social and financial objectives in order of explicitness. Visual inspection of Table 1 also reveals that the companies were more explicit in the ways they presented their financial health; economic performance (ROI); investment in people; and implementing programmes and policies to minimise the adverse effects of their operations on the environment than other sustainability criteria especially non-acknowledgement of the facts that there might be other potential benefits from building “green” which could impact on their financial performance. It also emerged that Company A’s corporate strategies were the least in addressing the triple bottom line sustainability goals.

Data collected shows that the companies investigated strive to meet the triple bottom line sustainability goals through their highlighted corporate strategies. That these companies have grown sustainably, survived and matured over time is demonstrated by the fact that the leadership of the companies spans over many steps of command/hierarchy, with some of the companies having more than 25 directors and over 5000 employees. All the companies also have in place well formulated succession plans and growth paths. However, although these construction companies have grown overtime (some established over a 100 years ago) into large thriving organisations with regional branches and international subsidiaries, the data collected suggests that the companies do not seem to pay enough attention to potential financial benefits from building “green” from which more income can be generated. The companies effectively address all aspects of sustainability at the operations and corporate level except for acknowledging that there are financial benefits other than the more obvious trading profits which can be derived from “green” building practices and which should be explored.

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Table 7: Construction Company Triple Bottom Line Sustainability Assessment

Companies / Sustainability Criteria	A	B	C	D	E	Mean Average
Economic						
Financial Health (Liquidity/Solvency)	3	3	3	3	3	3.0
Economic Performance (ROI)	3	3	3	3	3	3.0
Trading opportunities/trade network (Level of Risk Exposure)	2	2	3	3	3	2.6
Potential Financial Benefits from building "green"	1	1	1	1	1	1.0
Mean Average Economic Sustainability Criteria	2.3	2.3	2.5	2.5	2.5	2.4
Social Sustainability						
Internal human resources (employment stability)	3	3	3	3	3	3.0
External population: job creation; education, health care	2	3	3	3	3	2.8
Stakeholders' participation (knowledge within the company)	1	3	3	3	3	2.6
Macro-Social Performance (impact on the economy (GDP) & environment	2	2	3	N/A	N/A	2.3
Mean Average Social Sustainability Criteria	2.0	2.8	3.0	3.0	3.0	2.8
Environmental Sustainability						
Products/services (replaces demands for non-green products/services)	3	3	3	3	3	3.0
Commitment to environment principles in its business operations	2	3	3	3	3	2.8
Competitiveness (Greener than traditional construction)	2	3	3	3	3	2.8
Mean Average Environmental Sustainability Criteria	2.3	3.0	3.0	3.0	3.0	2.9
Mean Average Sustainability Criteria per Company	2.2	2.6	2.8	2.8	2.8	2.6

Key: ***N/A*** *(Not available)*; 3 = High (stated explicitly in company profile); 2 = Average (implied); and 1 = Poor (Not stated).

6.0 CONCLUSION

The research examines the corporate sustainability strategies frequently used within high performing listed South African global construction companies. The aim of the paper is to contribute to the discussion on corporate sustainability in the context of the construction sector and using indicators of sustainability in assessing whether construction companies incorporate sustainable objectives in their strategies. The study established that the sustainability strategies used by high performing construction companies listed on the Johannesburg Stock Exchange meet the triple bottom line of economic, social and environmental capital and that the construction companies do not seem to focus on the potential benefits which could have been accrued from building "green" component of economic sustainability. The paper concludes that

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although large high performing South African construction companies incorporate sustainable development objectives into their corporate strategies there is still room for improvement in the sustainable development and performance of construction companies in line with established sustainability indicators.

The paper recommends that the sustainability framework and criteria adapted from previous studies and used in this research can be used as a basis for evaluation of the sustainability development objectives of construction companies and as a quick guide for clients in project procurement and contract award. The sustainability framework developed would also assist the management of construction companies in expressing sustainability objectives and strategies in concrete operational terms. However, there is a need for further studies using a larger sample size and more objective methods of measurement to validate the results of this study and to establish the relevance of the framework criteria for construction company sustainability assessment. Also, further studies would be required to analyse the link between environmental and social sustainability and a firm's profitability (economic sustainability). Is there a business case for the Emerging Contractor Development programmes instituted as an operating condition for established contractors by the government in South Africa? In addition there should be studies into the time dimension of sustainability - does sustainability equate to growth? It would also be interesting to know whether the sustainability objectives set out by these companies in their profiles are actually practised and also whether there is a relationship between the level of sustainability goals instituted and corporate performance.

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ACHIEVING SUSTAINABLE DEVELOPMENT THROUGH APPROPRIATE TECHNOLOGY USE - THE CASE OF STEEL CONSTRUCTION IN BRIDGE STRUCTURES

Morgan Dundu

Abstract

Structural steel has been an essential part of bridge construction during the early history of the Southern African region, and today it is still performing the same function with distinction. It continues to play this role not only because of the advantages it offers the client/designer and the contractor/fabricator during the design and construction stage but also the benefits that it offers once the bridge is complete. High strength-to-weight ratio, durability, minimal substructure costs, fast construction periods, aesthetics and environmental issues are some of the factors that make steel the preferred material choice for bridge construction.

Keywords: Structural steel, bridge construction, maintenance strength-to-weight ratio, environmental.

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1.0 INTRODUCTION

Structural steel was the dominant material of choice for long span bridges, in the Southern African region, during the early 19th century. This happened despite the fact that, during this period, steel was not manufactured in this region. However, the region had free access to any construction material since trade was almost unrestricted. During this time a variety of landmark bridges, such as the Victoria Falls Bridge and Otto Beit Bridge over the Zambezi river, Birchenough Bridge over the Sabi river, Alfred Beit Bridge over the Limpopo river and several other river crossings were constructed.

The elegant Victoria Falls Bridge is built over the second gorge of the Victoria Falls. This makes it a huge tourist attraction. The construction of this bridge led to the development and growth of the towns of Victoria Falls on the Zimbabwe side and Livingstone on the Zambia side. Designed by George Andrew Hobson of Sir Douglas Fox and Partners (later to become Freeman, Fox and Partners), and not by Sir Ralph Freeman, as is often stated, the bridge was made and assembled in England, before being shipped to the Mozambique port of Beira and then transported by rail to the Victoria Falls (Hobson, 1907;Williams, 1909; Hobson, 1923). It took the British firm, Cleveland Bridge and Engineering Company, just 14 months to construct the bridge, at a cost of US$115,200. At the time of construction the Victoria Falls Bridge was the highest structure and had the widest span of any arch in the world. In 1995 the Victoria Falls Bridge was awarded International Historic Civil Engineering Landmark status by the American Society of Civil Engineers, and this was the first time such an honour was bestowed on a bridge in Africa.

The single arch bridge, Birchenough Bridge, is located over the Sabi river along the Mutare Masvingo road, in Zimbabwe. It was designed by Ralph Freeman, who also designed the Sydney Harbour Bridge and the Beit Bridge over the Limpopo river (Smith and Freeman, 1945). The Birchenough Bridge resembles the Sydney Harbour Bridge; however, it is only two-thirds as long as the Australian bridge. High strength steel made it possible to reduce the cost of the bridge and avoided the necessity for making piers in the unstable river bed. The erection process was similar to that used for the Victoria Falls Arch and subsequently for the Sydney arch, where the arch were constructed in two halves as cantilevers, anchored back to the rock shores by wire ropes. The ropes used to anchor the Sydney Harbour Bridge were also used to anchor the Birchenough Bridge and were finally incorporated into the bridge as suspenders of the roadway. Heavy pieces of steel were delivered to the west bank of the river by road and the steelwork for the east side was carried across the river by a cableway. The bridge was constructed in 20 months, and it was the third longest single-arch suspension bridge in the world at the time, exceeded only by Sydney Harbour Bridge and the Bayonne Bridge over the Kill van Kull Creek, south of New York in the USA. A village, named after the bridge, sprung up next to the bridge followed by a small-scale farming area. In 1984 the bridge was widened from 7.2 m to 10 m and strengthened as part of the World Bank's Highway Project One, to do away

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with the 40 tonne load limit imposed on the bridge in the 1970s. The bridge is widely considered by Zimbabweans as one of the country's finest pieces of architecture, and as such, it appears on the twenty-cent coin.

The Otto Beit Bridge was the first modern suspension bridge outside the United States built with wire cables (Smith and Freeman, 1945). The bridge was built by the Cleveland Bridge Company at a cost of US$297,600. The bridge was built to carry vehicle traffic from Zimbabwe to Zambia, extending the road network from South Africa and East Africa. Two small settlements (Chirundu village on the Zimbabwean side and Chirundu town on the Zambian side) were established as a result of this bridge. The Alfred Beit Bridge spans across the Limpopo river, at the border between Zimbabwe and South Africa. The structure of the bridge is a lattice girder truss, supported by piers. Its construction led to the development and growth of Beitbridge town (named after the bridge) in Zimbabwe and Musina town on the South Africa side. Today the bridge is now used only for rail traffic, as the new bridge, built in 1995 by the Zimbabwean government, now handles the vehicle traffic.

2.0 LIMITED USE OF STEEL IN BRIDGES DURING THE MID-19TH CENTURY

The use of structural steel in the bridges above exploited its advantageous properties of economically carrying heavy loads over long spans with minimum dead weight. Today, some of these bridges continue to serve their purpose. After this intensive phase of developing the transport infrastructure, the choice of material for use in bridges changed. Some of the notable reasons that caused the limited use of structural steelwork in local bridge construction are as follows:

- Since the bridges over major rivers had already been constructed, it was felt that the region did not need long span bridges anymore, and that steel was too expensive for short-span applications. All short and intermediate span bridges were then built of concrete. A well-established pre-stressed concrete industry provided an acceptable economic solution for bridges up to about 25 m span.

- The use of structural steel in the region switched from bridges to the construction of other structural systems. These systems ranged from small factories and warehouses to power stations and steel mill complexes.

- When it was felt that a concrete bridge was cheaper than a steel bridge, bridge designers thought that the preparation of alternative designs in steel was just a waste of time, with negative cost implications. There was very little incentive for the consultant to prepare two complete designs and schedules of quantities prior to the issue of the tender. The re-design and construction of Emlenton bridge in steel, in the USA, not only saved the client a lot of money, but also enhanced the aesthetics of the structure by eliminating three of

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the five piers required for the original pre-stressed concrete design (Schwendeman, 1987). The two piers, rather than five, presented less obstruction to stream flow and river traffic.

- The steel industry should, to some degree, be blamed for not selling itself forcibly enough and not providing clear solutions on doubtful issues such as corrosion protection. The procedures of painting, specified by the relevant authorities, were not standardised, despite the existence of local codes of practice for corrosion protection. In addition very little information had been published on the relative merits of using common painting systems for the different atmospheric conditions in South Africa. The result of this is that a great deal of money was wasted by calling for the same painting specification in, say, Cape Town (coast) and Johannesburg (inland), where the corrosive conditions are vastly different.

- When the first bridges were constructed most of the countries in the region were colonies of UK, thus they were treated as an extension of the British Empire. As soon as this position changed, importing steel became costly. Local engineers were forced to design with locally produced materials in mind. Reinforced concrete was then used as the major bridge construction material even if it was not the most economical or ideal engineering solution.

This position changed during the past 20 years. Steel staged a strong comeback that has continued to strengthen ever since. Structural steel is now recognised as the most sustainable option not only for long-span bridges, but also for shorter span bridges as well. Claims that steel bridges require more maintenance than concrete bridges is misleading, since both type of bridges (steel and concrete) require almost the same maintenance. Factors that necessitated this dramatic change are discussed below.

3.0 FACTORS BEHIND STEEL'S STRONG PERFORMANCE IN BRIDGES

3.1 Availability of the steel material

One of the most important factors which has encouraged the use of steel in bridges is the availability of the material. South Africa now produces its own steel and is ranked as the largest steel producer in Africa, producing about 50% of the total crude steel production of the continent. South Africa produces about 9.1 million tonnes of steel. About 5.3million tonnes of the steel produced, is consumed domestically. The major producers of carbon steel in Southern Africa are ArcelorMittal Steel and Highveld Steel, and both are South African companies. ArcelorMittal Steel is the African continent's dominant steel producer, producing about 8 million tonnes of steel per annum (http://www.arcelormittal.com). Highveld Steel and Vanadium Corporation steelworks produces an annual capacity of about 1 million tonnes of steel (http://www.highveldsteel.co.za). Other smaller South African steel producers include Scaw Metals, Cape Gate, and Cape Town Iron & Steel Works (CISCO). The country's sole producer

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of primary stainless steel is Columbus Stainless. ZISCO Steel, a steel manufacturing company in Zimbabwe, and ArcelorMittal Steel's Mozambique operations stopped operating a few years ago. Despite these setbacks, steel continues to find its way as an alternative to concrete, with considerable engineering effort being directed towards the fabrication of larger, previously imported, steel sections.

3.2 Innovation in production of steel

Steel has always been known to be an expensive material in comparison to reinforced concrete, its competitor. Improvements in process technology of the steel raw material, and availability of steel grades with increasingly high strength/weight ratios (yield stress exceeding 350MPa (Steel construction, 2010a)) has contributed significantly to the reduction of costs and design of bridge structures. Steel is a material of high quality, and is readily available worldwide in various certified grades and sizes. The testing programmes performed at steel mills gives confidence to all clients and engineers who specify steel for their project. Also, the steel industry now produces steels capable of creating innovative forms; steels that can be welded without special precautions and steels with higher corrosion resistance. Some of these steels have the ability to coat themselves with a protective layer under certain conditions of exposure. This reduces maintenance or repainting of the bridge structure. The other aspects that the steelmakers have improved include the steel's increasingly competitive quality/price ratio, the expansion of plate size ranges, the improvement of thickness tolerances and the production of variable-thickness plates. Thus, in each section of the plate, the thickness of the steel can be precisely tailored to the stresses to which the plate will be subjected to, once the deck is in service. This substantially reduces the quantity and weight of the steel, and the size of welds.

3.3 Innovation in design of structural steelwork

The following contact information may be provided as a footnote for all authors of the paper: current employment affiliation; postal and electronic mailing address. The strong comeback of steel bridges is also due to the efforts of the bridge designers. Designers have developed a better understanding of the behaviour of steel bridges and the steel that make-up these bridges, including modern methods of analysing bridges. Steel details have been simplified, thus the designers are now able to create more refined structures. Ultimate limit state design of deck-slabs has reduced slab thicknesses. Consequently the girder sections are lighter, sizes of fillet welds are smaller and resultant costs are lower. The high strength to weight ratio makes the steel lightweight, in comparison with concrete construction. This minimizes the substructure costs of bridges, especially in poor ground conditions.

A range of bridges for which each structural system (steel plate or box girders, etc.) should offer a viable and economic solution has been defined. The type of steel bridge ranges from the twin-girder for small and medium spans, to the suspension bridge for exceptional spans (see Figure 1). This guideline offers an efficient way to help reduce wasted effort in preparing alternative

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designs in unsuitable cases. It should be noted that whatever solution is chosen in any particular case, the solution should also depend on a broad spectrum of parameters such as pier height, available clearances, foundation conditions, associated earthworks, locality, accessibility, interference with other services during construction.

(a) Girder bridges (b) Arch bridges (c) Cable-stayed bridges (d) Suspension bridges

Figure 1 *Choice of steel bridge (Pontet and Vigo, 2004)*

The introduction of composite construction optimised the use of each of the materials. The concrete slab is only strong in compression which is ideal for the upper part of the deck, whereas the steel girders have strength both in compression and in tension which is ideal for the lower part of the deck. Rigidity in twin-girder structures is provided by the transverse deck geometry (principally its height), which increases as a function of the structure's span up to maximum span of 100m. Beyond this span the mass and cost of the twin-girder becomes too high, launching process becomes extremely difficult and the clearance beneath the structure becomes small. Many river crossings, existing roadways and railways could be made more economical using steel by reducing the number of piers and the formwork to support the concrete structure. Steel bridges can easily be strengthened (e.g. by the addition of steel cover plates to existing members) to resist increased loading, modified/widened during its service life or repaired in the event of accidents, with well proven techniques like heat straightening (Modern Steel Construction, 1986). This ensures that damaged structures are soon back in use. During the 1970s the Birchnough Bridge, in Zimbabwe, was widened and strengthening to cater for increased traffic loads. Span-to-girder depth ratios for simply supported girders (up to 20:1) and continuous bridges (up to 30:1) have developed (BS5400-3, 2000).

3.4 Innovation in construction of structural steelwork

The elements of the steel bridge framework are prefabricated and manufactured under controlled conditions, and to established quality procedures at minimum cost. Fabrication methods such as plate marking/preparation, saw/drilling and assembly/welding are now partially or wholly automated, resulting in reduced costs and increased rate of throughput. This results in shorter and more predictable construction programmes. The successful construction of major bridges in steel has largely been determined by the speed of erection offered by steel. Since most of the work is done in the workshop, steel construction is not affected by changes in the weather condition. In steel construction, complex operations are rehearsed so that everyone understands their precise role when they reach site.

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Today, many new bridges have to be built over existing traffic routes, or as a replacement for existing bridges. In such situations, speed of construction and minimising disruption are very important factors. The developments of high capacity transport and lift equipment, such as cranes, coupled with the relative lightness of structural steel girders, has led to the manufacturing of larger and heavier weldable elements in the workshop that can easily be transported and erected on site. Once on site the elements can quickly be lifted into position. This approach minimizes or eliminates disruption to road and rail users during construction, and lead to shorter construction periods, which is very important especially in hostile environments. This not only leads to an earlier usage of the bridge, but also results in reduced supervisory and site establishment costs which are particularly significant in remote areas. A steel structure gives the contractor the flexibility of choosing the erection process. Cranes, launching, slide-in techniques are some of the methods that can be used to install the components of the structure. The components can then be sized to suit access restrictions at the site, and once erected the steel girders provide a platform for subsequent operations.

In the past the visual aspect of bridges did not receive much attention, however, today there is a greater awareness of this aspect to the users and to the general public. This is particularly the case if the structure is a pedestrian and cycle bridge, including modestly-sized highway bridges. Architecturally, steel bridges have more possibilities, since steel bridges can be sculptured to any shape or form. Aesthetically, the finished steel bridge is slimmer than its competitors. The painting of steelwork gives the structure colour and contrast, and the appearance of the bridge can look new if re-painted (http.//www.arcelormittal.com).

3.5 Maintenance of steel bridges

It has always been thought that concrete bridges are more durable than steel bridges. History has proved that this is not true. Examples cited in the introduction have shown that steel bridges can be as durable as concrete bridges, and in some cases can be more durable than concrete bridges. Steel bridges now have a proven service life span extending to well over 100 years and low maintenance during their design life (Corus, 2005). The potential durability of steel was summarised by a Mr J.A. Waddell in 1921 when he said: “The life of a metal bridge that is scientifically designed, honestly and carefully built, and not seriously overloaded, if properly maintained, is indefinitely long.” Durability can be increased by using protective long-life coatings, such as hot-galvanising, or through the use of weathering steel, which needs no protective or other coatings. The American Galvanizers Association (2012) projected that hot-dipped galvanized (HDG) items will last 75 to 100 years in an aggressive marine environment. Figure 2 shows the time to first maintenance (TFM) of hot-dip galvanized coatings for different environments. TFM is the life until 5% of the surface is showing iron oxide (red rust). This point does not mean that the steel has been weakened; however, it means that a corrosion protection system must be applied to extend the life of the steel product. It should be noted that in order to achieve a quality corrosion protection system, the surface preparation must be done well. Overlooking this aspect gives less than adequate results.

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For steel bridges that require painting it should be noted that today's structures do not require frequent repainting. Paints are now expected to last for about 30 years before a major touch-up of a modern three coat paint system (FHWA HRT-11-046, 2011). This brushes aside the perception that bridge painting is expensive and do not last. In steel structures, signs of deterioration/corrosion do not need extensive investigations and may swiftly be addressed by repainting the affected areas, as the structural elements are visible and accessible.

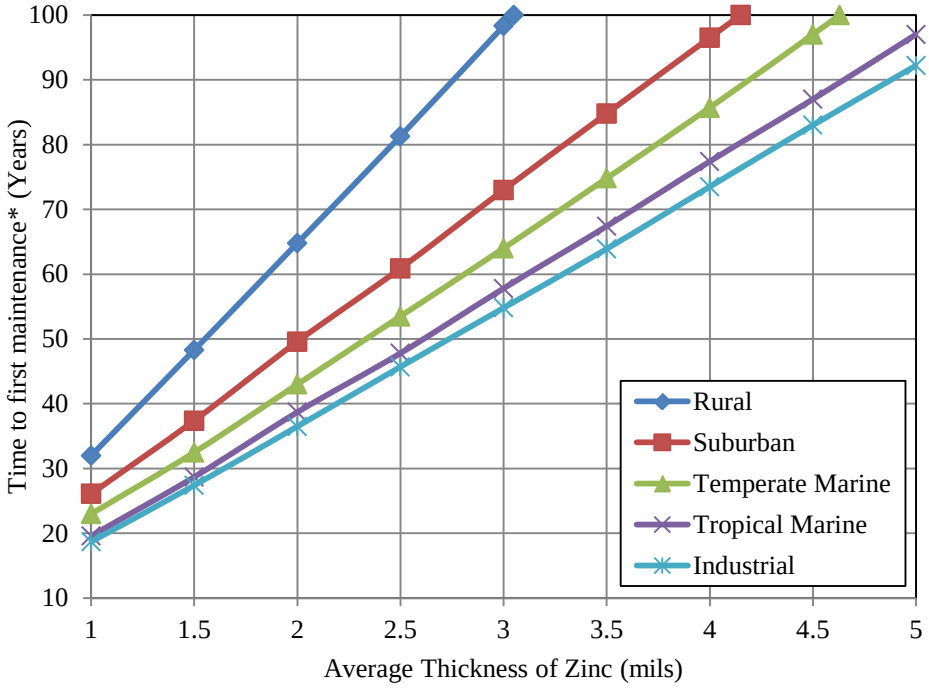

Figure 2: Time to First Maintenance (American Galvanizers Association, 2012)

3.6 Marketing

For the steel market to continue to grow, the steel industry will always need a promoter. The Southern African Institute of Steel Construction (SAISC) is the main promoter and centre of expertise of all aspects of steel construction in Southern Africa, and the institution is based in South Africa (http://www.saisc.co.za). The institute operates a bursary scheme to entice young engineers into the steel industry and sponsors research programmes at several universities. It also invites eminent overseas lecturers to enhance steel design courses at local universities and offers continuing education courses to recent graduates and practising designers. To mitigate against the shortage of skilled structural steelwork detailers in South Africa, SAISC and DSE Structural Engineers & Contractors (specialist in the design, detailing and fabrication of structural steelwork and platework) established the SAISC/DSE School of Draughting in 2007, to train learners in structural steel detailing.

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3.7 Social

When a steel bridge is constructed, society gains in many ways. Disruption to road and railway users is minimised since steel bridges can be installed within a short time (Damoulakis, 2000). Offsite fabrication means that there is less noise to the local communities caused by construction vehicles. The short construction period means that the impact to local people and businesses will be as short as possible. The use of automatic production in the workshop, fewer workers on site and the less time spend on site makes the environment safer. In UK, reportable accidents in the structural steel industry have been reduced by 60% since 2000 (Bartlett, 2012). Because most of the work is done in the workshop, the steel worker spent most of his time with his family, thus benefiting family life.

Landmark steel bridges, such as the Mandela Bridge, stimulate regeneration of many neglected areas (Steel Construction, 2003). Proper access to social and economic facilities and services, such as clinics, schools, and commercial centres, is amongst the highest development priorities for many people living in rural areas. When they are carefully placed at strategic crossings, steel footbridges can improve rural access and can considerably reduce the time it takes for people to transport their farm produce to the market and reach other services and facilities they need. In Zimbabwe and South Africa such interventions have proven to be of life saving importance for children walking to school, while providing all year round access to other services at the same time (Chipuru, 2001; de Clerq, 2002; Steel Construction, 2010b,c; Steel Construction, 2011).

3.8 Environmental

Recent developments in bridge construction have shown a greater awareness of the impact of bridges on the environment. The use of steel in bridges represents a sustainable management of natural resources since steel is the most recycled construction material (Brimacombe and Shonfield (2001); Brimacombe, Coleman and Honess (2005)). Almost all structural steel either finds its way back into the steelmaking process where it is used to create new steel products, or is re-used. A typical steel recycling diagram is shown in Figure 3. In UK 94% of steel construction components are recycled to produce new steel or re-used and almost all steel reinforcement bars is produced from recycled steel (http://www.corusconstruction.com). Re-cycling steel does not reduce its performance, a characteristic not possessed by any other construction framing material (http://www.steelconstruction.org). This makes steel a permanent resource. Unlike concrete bridges, some elements of steel bridges can be re-used in other structures. In some cases entire bridges have been relocated.

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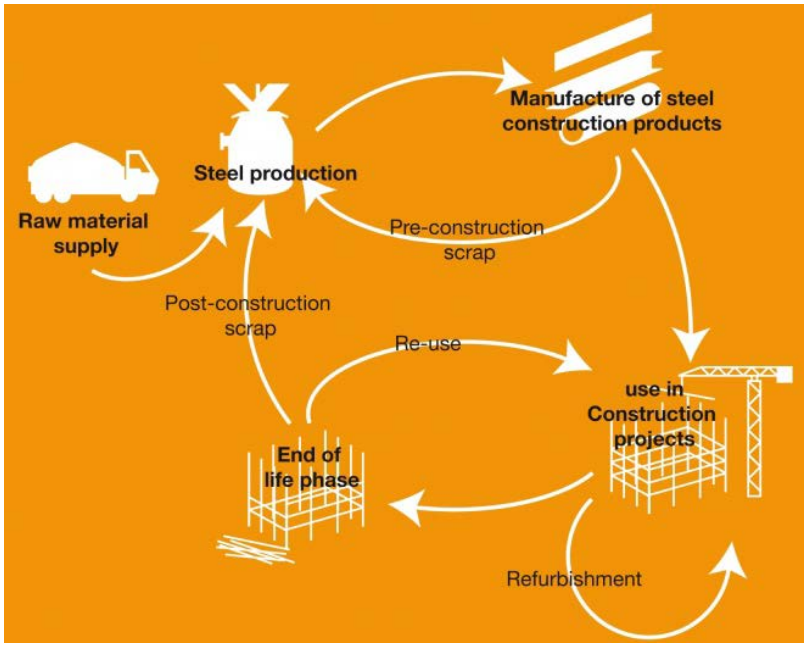

Figure 3 *Recycling diagram (http://www.steelconstruction.info/Bridges)*

Steel scores convincingly on two, key sustainability issues of energy consumption and $C0_2$ emissions. Comparative values for these issues are given in Table 1 (Hammond and Jones, 2008). This table must be understood from the fact that it is standard practice to express carbon and energy impacts per tonne or kilogramme basis, which may give a wrong impression that steel has a higher impact than concrete. Because steel has a high strength-to-weight ratio, the weight of steel required for a given application is far much less than concrete. It must also be noted that when new steel is created from recycled steel, rather than iron ore, CO_2 emissions are reduced. According to the International Iron and Steel Institute, recycled steel made up more than 40% (or 496 million metric tonnes) of the 1.240 billion metric tonnes of steel produced in 2006 (http://www.aist.org/education/Life of Steel). This saved an estimated 894 million metric tons of CO_2.

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Table 8: Embodied CO_2 and energy

Item	Embodied energy (MJ/kg)	Embodied CO_2 ($kgCO_2/kg$)	Density (kg/m^3)
Steel	20.10	1.370	7800
Concrete	1.11	0.159	2400

4.0 CONCLUSIONS

The discussions in this paper show that steel bridges are highly competitive. When steel is used there are no limitations on the span of the bridge. With its more efficient load-carrying capacity and lighter weight, steel members present fewer transportation and erection problems. Aesthetically, the finished steel structure is slimmer and has cleaner lines than concrete and other competitors. There is considerable potential, especially with the anticipated construction resurgence in the region, to specify and use more structural steel in bridges. The fact that steel is available in the region, can be coated with corrosion-resistant metals and finishes, can be formed into a wide variety of shapes and panels and is environmentally friendly shows the competitive edge that the material has. Today steel is the world's most recycled material; every piece of steel used in construction can be recycled again at the end of its life. Even steel construction scrap brings value when it is recycled rather than running up costs for disposal. This minimizes the depletion of the natural resource.

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SUGGESTIONS OF A SERVICE DELIVERY AGENDA FOR THE PROGRESSIVE PROFESSIONALS FORUM

Anyumba G.

Abstract

Municipal service delivery in South Africa is facing a multiplicity of challenges. The Government and built environment stakeholders are aware of what is not functioning and the actions to overcome the problems. The South African literature points out a range of both technical and political issues as the underlying reasons behind the poor performance of service delivery in municipalities. The landscape of the recent service delivery situation is briefly presented. Next reasons why the African National Congress (ANC) South Africa's dominant political party was selected for this study are outlined. Scholars and political critics have argued that the `cadre deployment' policy of the ANC, is responsible for the technical inefficiencies and encouraging corrupt practices that is behind the failing and poor service delivery in municipalities. Cadre deployment and the typical corrupt practices in municipalities are briefly outlined in this paper. I argue that deployment *per se* is not negative as is evident from meritocracy based deployment in the Republic of Singapore and the Communist Party of the People's Republic of China. A general description of meritocracy is presented. In the above two countries, meritocratic delpoyment has created employment through economic growth resulting in lifting a large proportion of China and Singapore's people from poverty, although inequalities in these socieities persist. Thus meritocratic political deployment in Singapore and China has addressed two out of the three South African challenges, namely poverty and unemployment whilst improving their respective national infrastructure. The Progressive Professionals Forum (PPF) is a new `think tank' of professionals within the ANC. I argue that as the PFF is strategically allined to the ANC and given the space it has been promised to contribute to the party policy it should sieze the opportunities to examine serivce delivery as a prioirty agenda. The aim in keeping with PPF's objectives of encouraging and nurturing progressive thinking that may initiate self-adjustment of failed development policies of the ANC.

Keywords: Service Delivery Challenges, Cadre Deployment, Corrupt Practices, Meritocracy, Republic of Singapore, People's Republic of China, Progressive Professional Forum.

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1.0 INTRODUCTION

South African literature on service delivery points to the concern that the provision of services to communities is problematic and there appears to be no viable solutions to the situation. The failure of service delivery since 2007, is evident from the poor fiscus standing that the Auditor General South Africa makes in his annual reports, quantified alarming levels of corruption in municipalities, and the increasing frequency of service protests throughout South Africa. This paper accepts that there are technical issues, as pointed out by the Presidential Infratructure Coordinating Commission, that require to be addressed. However, the paper devotes a large part of its presentation on the political issues and that are not addressed by the responsible authotiries. This paper argues that there are international case studies that should be studied and considered as part of an approach to South Africa's solutions to the challenges of service delivery.

The paper starts with the South African Government acknolwledgment of the challenges of infrastructure provision and identifies actions to overcome the problems the country faces. In expanding on the theme, the following section presents the charateristics of service delivery protests between 2007 and 2012, a period that has recived some detailed scrutiney. The repercussions of cadre deployment is followed by what corrupt practices manifest in South Africa's municipalities today. Extracts from the Auditor General of South Africa's reports for 2010 to 2013 are presented that briefly pin point the problematic areas it finds with municipalities.

To try understand the forces behind the poor and non delivery of services, the paper next presents the ANC and its policy of `cadre deployment' that has been the subject of criticism by the media and scholars. The paper next examines the concepts of meritocracy and how these have impacted in the Republic of Singapore, a multiparty democracy and in the Communist Party of China in a single party state. The short history of the PPF is examined to determine if it has the space to contribute to ANC policy.

A discussion follows that retracts the argument of the paper and suggests that the PPF is strategically placed to *potentially* lead a shift to a culture of meritocracy within the ANC. A service delivery research agenda is suggested that recommends that concerned professionals and other stakeholders identify how meritocracy in decision making structures might be applied to start a corrective course of action in South Africa.

The paper concludes firstly that if the dominant ANC does not self-correct its cadre deployment policies and take the path of meritocracy, South Africa can only expect a worsening of the service delivery situation under the ANC. Secondly, that from international case studies, meritocracy can lift the people out of poverty and create employment opportunities through having the right people that will lead infrastructure planning and implementation. However,

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metrocracy cannot totally eliminate croynism or corrupt relationships in the decision making structurtes.

2.0 RESEARCH DESIGN

The research design was essentially a desktop approach focused on gathering and analysing secondary information. The secondary sources of information sought were that which aimed to convey and clarify the complex situation from the viewpoint of Government and its critics. Two international case studies are also presented on what governments have undertaken to transform their societies in respect of the political organisations. The study involved the search through critical literature focused at the local government level. All secondary data and information was accessed through electronic means.

3.0 GOVERNMENT'S VIEWS ON INFRASTRUCTURE CHALLENGES

The Presidential Infrastructure Coordinating Commission (PICC) listed the following in 2012 as the challenges in the way of delivering and improving the performance of infrastructure projects in South Africa; `Poor planning at institutional levels, slow approval of projects, the late start to projects, poor quality of execution, high costs and monopoly pricing, poor industry reaction time, poor project controls that include schedule, cost, quality, safety, health and environment; tender abuses and corruption, unrealistic acceleration, unplanned and costly rework of designs or construction, the lack of political alignment with no champion, permitting for e.g. Environmental Impact Assessment (EIA), rework or delays, lead time delays and the slow or non-payment of contractors'. The above factors should be familiar to professionals, consultants, civil servants and politicians who have been involved in the execution of Government work.

The PICC also identified in its 2012 Final Report of actions that Government considered could overcome the above infrastructure challenges. These included the following: `Programme to coordinate improvement in project-related skills, project management and engineering skills within the State, alignment of the national, provincial and local structures, alignment of investment plans with funding allocations, long-term support for long-term projects especially regional projects, setting in predictable process for triggering of national projects, including regulatory approvals, strong policy direction for incentivisation of supplier development, localisation and private sector participation, plan and build projects that promote low life-cycle costs, standardised designs and delivery, full life-cycle costs recovery through user tariff or a committed funding strategy, strengthening project controls and monitoring in Government and State-owned Enterprises (SOE), standardised and simple automated reporting to track project progress and performance, early warning to address bottlenecks and new compact with private sector'.

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The above points to the lack of the technical alignment of government planning and implementation processes, the dearth of competent people heading institutions, the deficiency of professional and experienced people with the capacity to conceptualize, plan and implement work within acceptable quality parameters, indifferent decision making and too many institutions over burdened with red tape, the readiness to engage in corrupt relationships without fear of the consequences and short term vision and political engagement. The implications are that the peoples, systems and institutions, require functional interventions.

4.0 THE SERVICE DELIVERY SITUATION

Corporative Governance and Traditional Affairs (CoGTA) (2005) states that municipalities are responsible for water supply, sanitation, health centres, electricity and other energy sources, roads and storm water drainage and solid waste disposal. The failure to deliver the above would be the primary trigger of a service delivery protest. South Africa's service delivery protest tends to be violent.

Violent protests are instances where participants have engaged in physical acts that cause or result in harm to some person or persons. It has been noted violent protest in South Africa typically aim at the intentional injuring of the police, foreigners or government representative, the burning down of built structures (houses, shops or stalls) and the looting of shops. The throwing of rocks at innocent motorists, the burning of tires and vehicles as roadblocks are typical activities in a violent service delivery protest. Service delivery protests tend to be linked with the failure to provide what has been promised and expected from national, provincial or local politicians.

Jelani Karamoko and Hirsh Jain (2011) identified the following as the leading six causes of service delivery protests that related to (i) Housing, (ii) Electricity, (iii) Water, (iv) Sanitation, (v) Service delivery itself and (vi) Corruption. Karamoko, Jain (2011) and Cronje (2012) also noted that iin the background of a typical service delivery protest were political party struggles (between parties and within parties) in municipalities that often provoke civil unrest, as a way of concealing political motivations.

Other `minor' causes of service delivery protests include failure to deliver infrastructure, unfavourable council decisions, health related issues, education, protests against specific persons, the state of unemployment, poverty, land surveys or unfavourable allocations, living conditions, safety and crime, incompetent officials, inability to engage in illegal acts, broken promises and police misconduct.

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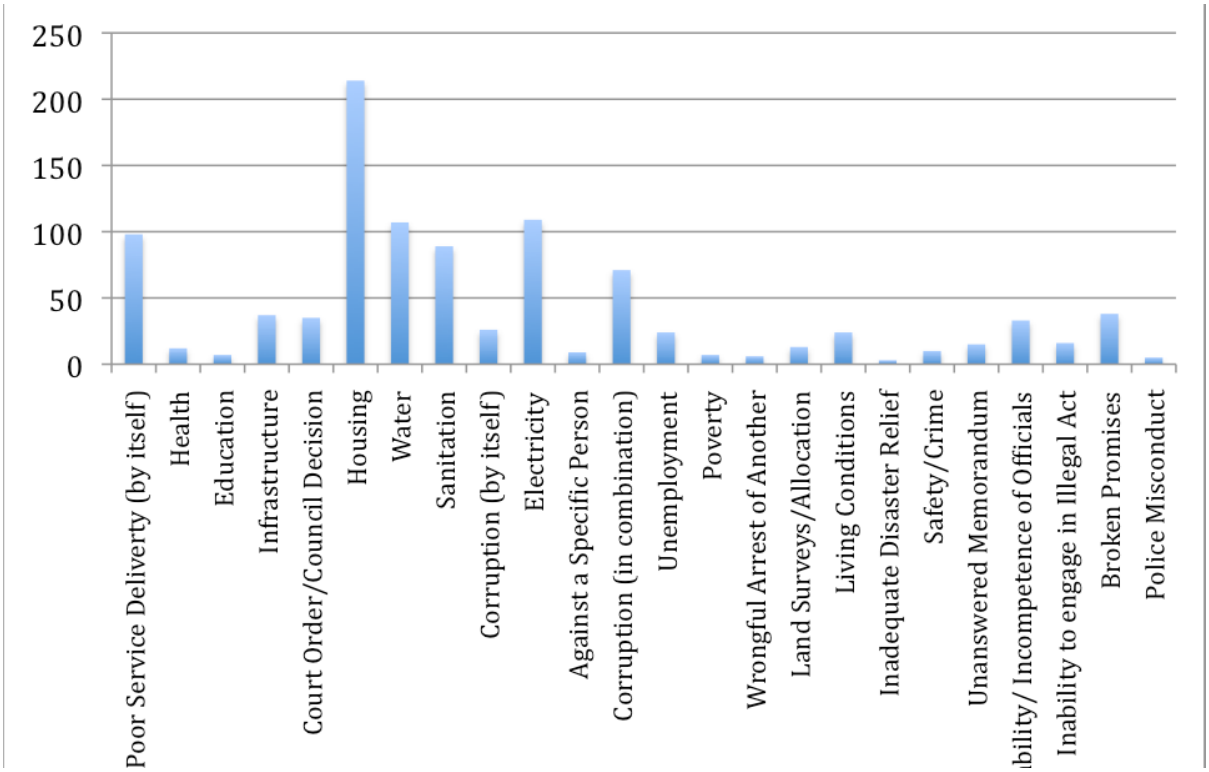

Figure 1: Protestor Complaints Feb 2007 to May 2011
Source: J. Karamoko & H. Jain (2011)

In Nontando Guwa Ngamlana's study published in 2010 on `who was to blame' for the violent protests, the following were the underlying causes. (i) Unfulfilled promises, (ii) Dissatisfaction with service delivery, (iii) Voice of the people not being heard, (iv) Deployment of unqualified ANC comrades, (v) Corruption and nepotism in local government and (vi) the lack of a critical voice that represents civil society. Refer to figure 1, above for the full range of issues that sparked protests between 2007 and 2011.

Hirsh Jain also plotted the frequency of service delivery protests. Refer to figure 2 below. It illustrates a lower level of protests nationally before the rise in 2009 and 2010 before a declining rate of community protests that coincided with the FIFA Soccer World Cup in June 2010. Jelani Karamoko and Hirsh Jain conclude that their findings suggested that there remained strong public discontent with municipal service delivery throughout the country. Furthermore, the strikes were accompanied by unprecedented rates of violent protests.

In relation to the above factors, Karamoko and Jain concluded that: Fundamentally community protests are an expected consequence of systemic failures in the provision of basic services to the poverty-stricken citizens. Secondly that in the absence of the ability to remedy these failures immediately, smaller measures that reduce the potential for outbursts of violence ought to be considered. That putting in place measures is especially critical since the anger generated

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during a violent protest often fuels further violent protests. It was observed that visits from government officials were often negative but sometimes positive. It sometimes helped to quell service protests and in some cases such visitations have made matters worse.

Nontando Guwa Ngamlana pointed out in his study that aside protestation against corruption, the indicators all point to the failure to deliver built environment related services.

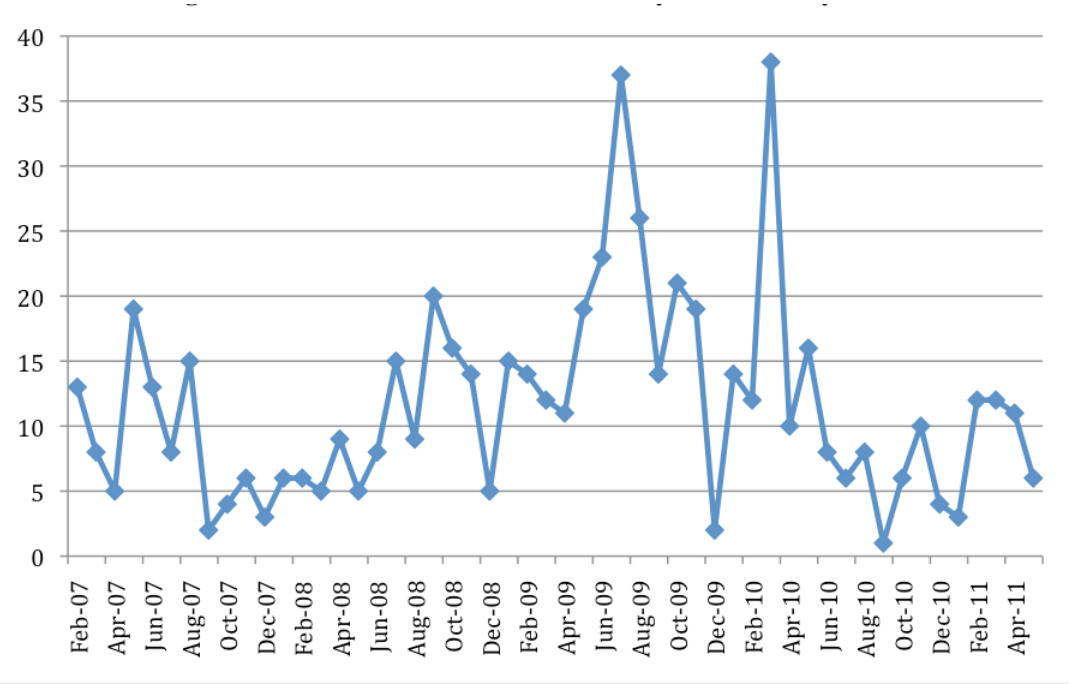

Fig 2: Frequency of protests per month February 2007 to May 2011
Source: Hirsh Jain 2011

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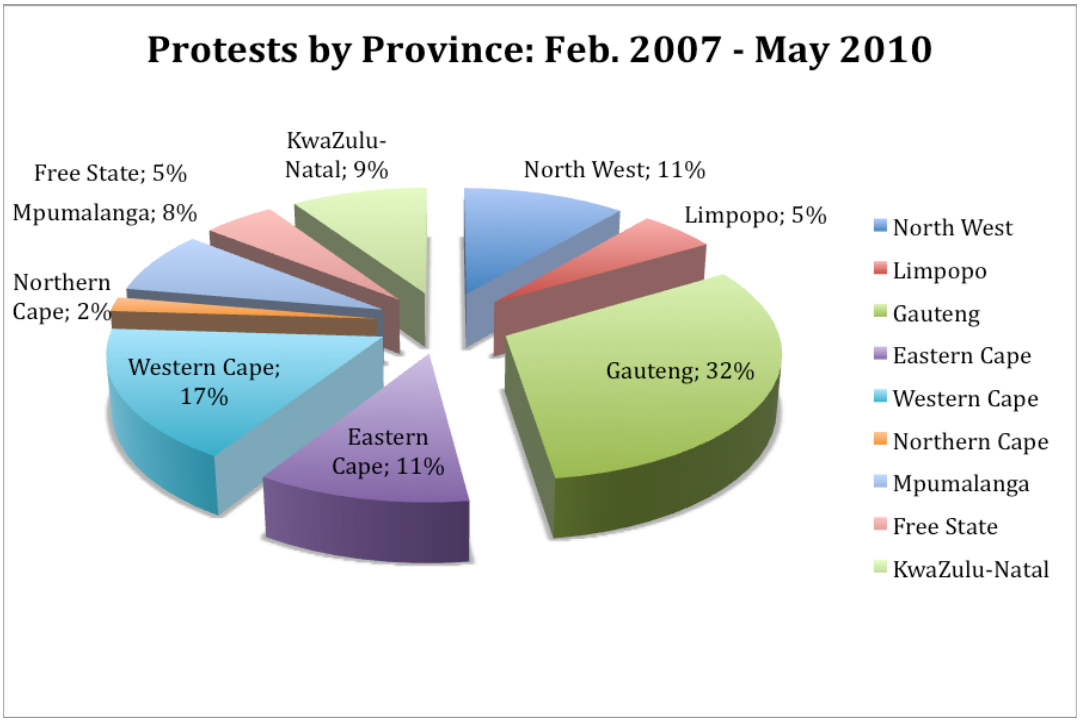

Figure 3 : Geographical distribution of protests
Source: Hirsh Jain 2010

Earlier on Jelani Karamoko and Hirsh Jain (2010) studied the geographical spread of service delivery protests. A composite picture is represented in figure 3 above. They quote that in a Municipality IQ press release on ` Municipal Hotspots' in July 2009, it was remarked that Gauteng, North West and Free State were the predominant focus of protests. Another conclusion was that protests demonstrated that they are largely an urban phenomenon, resulting from the *relative deprivation which members of a community feel when compared to their more affluent neighbours'*. In other words, Municipal IQ suggests that communities are more likely to protest when they are `languishing at the periphery of municipalities', a phenomenon that is most common in metropolitan areas.

In a post 2011 Multi-Level Government Initiatives study of service delivery protests Jelani Karamoko revealed that service protests had risen in the first 8 months of 2012, with 226 protests, or an average of 28.25 protests per month. This made 2012 the year with the largest number of recorded protests. Cronje (2012) places service delivery protests in a wider time perspective. He states that `Municipal IQ reports that the number of major service delivery protests increased from 10 in 2004 to more than 100 by 2010. Data from the police suggests they are now responding to three protests every day' (i.e. 2012).

The Auditor General South Africa (AGSA) is an important independent institution whose function and reported opinion is important in the subject matter of service delivery. This is a brief section on the AGSA. The AGSA's mission is ` enabling oversight, accountability and governance in the public sector through auditing.' In the Annual Report 2010-2011 in relation to local government it

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was stated that AGSA was experiencing debt collection challenges. In the 2011-2012 Integrated Annual Report, it was again noted that certain local municipalities and entities were still failing to settle their accounts/debts. Debt collection from local municipalities remained a challenge. In the 2012-2013 Integrated Annual Report, it was reported that 94 municipalities (*i.e. one in every three municipalities*) was in `financially distressed'. Bad debt provision had risen from R 74 million in 2011-2012 to R 115 million in 2012-2013. Bad debt interventions were less effective in local government due to the financial challenges this sphere of government faced. The key MFMA message to local government leadership was to *intensify capacity building among councillors* to enhance administration. The report emphasized the *need for professionalism by hiring qualified personnel* (My emphasis).

5.0 THE AFRICAN NATIONAL CONGRESS AND SERVICE PROVISION

The following section explains why only the ANC and not the other parties were selected for this brief analysis. In 1994 the ANC won the first democratic elections with 62.6% of the vote. In 1995 municipality boundaries were re-drawn to 9 provinces, 283 municipalities, and 3,715 wards. Besides minor changes the above is the spatial extent of the administrative challenges service delivery.

Collette Schulz-Herzenberg (2009) notes that since 1994 South Africa's national and provincial electorial dominance by the ANC party increase nationally from 62.6% in1994 to 69.7% in 2004, and drop to 65.95% in 2009 elections. The 2014 returns shows that the ANC and was down to 62.15% Regarding trends in voter registration Schulz-Herzenberg remarks that `…Broadly, the percentages for voter registration and voter turnout reveal that South Africa has witnessed a general decline in electoral participation in terms of both these criteria… the number casting a vote between 1999 and 2004 actually declined.'

For the purposes of this paper the following are noted from noted from Schulz-Herzenberg's paper. Firstly, that with one dominant party there is an `electoral imbalances' in the South African party system. Secondly, that arising from the `imbalance' there are concerns of `the inability of elections to hold government accountable'. Third, that `when parties cease to 'fear the ballot box', like the ANC they are likely to become unresponsive and ideologically entrenched.' Forth, that `an extended and uncontested period in power can engender complacency, arrogance and corruption in the incumbent party.' Fifth, `that a dominant party, like the ANC, is able to take the citizenry's vote for granted because it is not seriously threatened at the polls.' Moreover, `predominant party systems may lead to increased levels of political apathy as predetermined electoral outcomes de-energise the political system and cause stagnation among voters'. Last but not least, `…where genuine political competition is diminished, certainty about the prospects of re-election invites predictable politics, which, in turn, signals the deterioration of responsive and accountable government.' Mashele P & Qobo M (2014) `The Fall of the ANC; What Next?' hold similar views, which they explore in great detail.

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Sarah Knoesen (2007) throws some light on how political parties in new democracies use infrastructure as leverage in their political vote winning strategies. First she notes that dominant parties such as the ANC apply the theoretical tenents of `redistribution' to address unequal resource distribution by focusing on social spending on visible projects that have `direct impacts' on the disadvantaged groups. Secondly, under `patronage', there is the incentive for a political party to act to maintain and or increase its support…and politicians `will award their core support group or swing-voters.' In the case of the ANC the core support group are its black voters. Knoesen further argues that between 1996 and 2001 the ANC used `*the allocation of new electricity connections, water connections and sewerage connections as political currency'* at the level of municipality wards and households. (My emphasis)

In 2012 Cronje of the South African Institute of Race Relations argued that the `ANC will be in the minority by 2024' for a number of reasons. These included ANC support which is falling very quickly that has occurred because a growing number of people are losing confidence in the ANC. He also noted the other root of the failures of the ANC is in education and dealing decisively with corruption. Cronje concludes that what the trends show is that the ANC is `not serious about addressing the failed education, low growth, unemployment, and corruption that underpins its flagging support.'

The purpose of this section was to present the arguments for focusing on the ANC and not any other South African national party. Mashele and Qobo have declared ANC as a party that has already fallen. However, the ANC is still the party of the majority voters, even if it is declining in the national elections and losing majority control of municipalities from time to time. Because the ANC will in all probability be the majority party in the South African political landscape for another decade according to Cronje's predictions, it's polices will continue to have impacts on South Africa. And this paper highlights one of its most criticized policy, that of `cadre deployment' next.

6.0 CADRE DEPLOYMENT

It has been pointed out above that `cadre deployment' policy by the ANC is politically responsible for some of the technical inefficiencies of municipalities behind service delivery and that the negative aspects of the policy are not being addressed by the ANC. Gareth van Onselen (2012) defines cadre deployment as, `The appointment by government, at the behest of the governing party, of a party-political loyalist to an institution or body, independent or otherwise, as a means of circumventing public reporting lines and bringing that institution under the control of the party, as opposed to the state.' Furthermore, deployment involves the process of bypassing merit to enhance control through positions of power and to dispense economic patronage through the public purse.

Van Onselen adds that according to the ANC's own internal definition, cadre deployment is designed to bring under the party's control "all the levers of power" which the ANC lists as "the

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army, the police, the bureaucracy, intelligence structures, the judiciary, parastatals, and agencies such as regulatory bodies, the public broadcaster, the central bank and so on". Van Onselen concludes that cadre deployment `is designed to ensure that every institution, independent from the state or not, is accountable first and foremost to South Africa's ANC.' Paul Hoffman (2010) depicts the wider context of cadre deployment as not only an ANC policy but as an arrangement of the ANC, South Africa Communist Party (SACP) and the Congress of the South African Trade Unions (COSATU).

Van Onselen points out that the High Court `struck down as illegal', ANC's cadre deployment policy has `it is prejudicial for the promotion of constitutionalism'. It may be added that, the ANC policy of deployment of cadres, the strategies of imposing candidates onto institutions, the elimination of undesirable opposition etc., have great similarities the descriptions of the workings of the Afrikaner Broederbond in Max du Preez's (2014) edition of Ivor Wilkins and Hans Strydom's `The Super Afrikaners'.

From time to time the ANC has defended cadre deployment. In 2011 the Mail and Guardian Newspaper quoted the ANC Secretary General as stating that there was nothing wrong with cadre deployment as it gave black people `operational exposure.' In 2013 amidst protestations against the policy, the ANC reiterated that `the ruling party wants reliable cadres to take South Africa into the future', and went on to state how cadres `relied only on their salary.' This is contrary to the often reported investigative journalism that reports of cadre abuse of State resources or ownership of property beyond their means.

The ANC Secretary General's message seems to be that nothing can be wrong or go wrong with cadre deployment. In 2013 The City Press reported that the Public Enterprises Minister Malusi Gigaba stated that cadre deployment to parastatal boards was acceptable if the individuals concerned are `skilled for the position.' However, Gigaba acknowledged that *deployment had gone wrong in many instances* (My emphasis). He added that this could be avoided in future by adopting a "scientific and systematic approach" to the composition of such boards. What constituted a scientific and systematic approach was not elaborated upon.

The above descriptions depict two types of deployees, `competent' and `not so competent' cadres. A third `in-between' type has been suggested, i.e. `independent thinking' cadres. Gavin Davis (2010) disagrees with the existence of such a category, because amid the *prime requirement for cadre to party loyalty* (My emphasis). He argues that `even competent cadres risk redeployment if they act impartially, undermining their integrity'. Davis adds that cadre deployment is `unique to political parties (like the ANC) steeped in the Leninist tradition of Democratic Centralism. This principle commits every cadre to defending and implementing the will of the party leadership, wherever he or she is deployed, and even if it means acting outside the Constitution and the law.' Davis noted that a cadre who dares to challenge the ANC leadership is sooner or later "redeployed"—voluntarily or otherwise.' Therefore, there are loyal cadres who go by the rule book and ex-cadres who are `excommunicated'.

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Cadre deployment has been criticized on a number of fronts that make extensive reading. Ahmed Areff (2010) writes that ANC's deployment strategy `demoralizes the public service'. However, Areff noted that `not all people deployed by the ANC are incompetent'. Mandy Rossouw (2011) pointed out that `The ANC's cadre deployment and political patronage for party loyalty has been extremely beneficial for Luthuli House (ANC's HQ), ANC cronyism has had catastrophic consequences for the rest of us.' And Rossouw noted that the impact on municipalities of cadre deployment were self-evident in the Auditor General South Africa (AGSA) annual reports. For example the AGSA's 2010/2011 financial year revealed `only 5% of municipalities received clean audits. No Metropolitan Municipalities received clean audits and 13% of municipalities did not even bother to give their financial statements in on time.' In 2013 the AGSA warned that the state of municipal finances was worsening due to the lack of `committed leadership'. Business Day (2013) reported that in the 2011-2012 Financial Year out of South Africa's 278 municipalities, only 3% or 9 municipalities had clean audits and 3 of these were in Democratic Alliances' Western Cape. The AGSA added that irregular expenditure amounted to R 9.82 billion and wasteful expenditure was R 568 million. This is was a doubling of the previous years' losses. The AGSA concluded that `*clean audits are achievable if there is leadership commitment'* (My emphasis).

The City Press (2011) quoting from the Christian Democratic Party (CDP) leader noted that `The actual problem is that the ANC…had too few capable cadres to cover all governing fronts'. It was suggested that appointments should be `managed by apolitical technocrats.' In 2012 the Government intervention to run a selection of Provincial departments in Limpopo, Free State and Gauteng Provinces was placed on the incompetent and corrupt deployees. In 2012 Gareth van Onselen reported in detail on `How cadre deployment has brought Buffalo City to its knees' The narrative is long and complex and revolved around perpetual vacancies of high office, rapid turnover of staff, ANC factional infighting and a collapsing financial management system and wastages. Cadre deployment was blamed for the politicisation of a municipality that, just five years previously, 'received a financially unqualified report from the Auditor-General' were the primary reasons given for this turn of Buffalo's fortunes.

The City Press on July 12 2012 reported that Human Science Research Council (HSRC) (2012) reported that the ANC cadre deployment was a serious obstacle that negatively affected public services. It observed that the ANC's deployment placed loyalty ahead of merit and even of competence was an obstacle to deliver efficient public services. McKeed Kotlolo (2012) referring to the above HSRC report noted that the ANC's deployment strategy lacked the political will to act against under-performing official was a major obstacle to achieving the goals of government policies. The result was "unauthorised, fruitless, wasteful and irregular expenditure."

This paper is not dismissive of cadre deployment. Cadre deployment can and does work, as exemplified in the politico-special interest lobbyist in countries that embrace multiparty politics where deployees are qualified, experienced and are competitively selected career specialists.

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Cadre deployment is also a feature of single party countries such as the Communist Party of China (CPC), which is discussed in a following section of this paper.

7.0 CORRUPT PRACTICES

Nontando Ngamlana has written extensively on the subject of corruption in South Africa's municipalities. In 2009 he pointed out the various types of corrupt practices in South Africa as consisting of bribery, fraud, embezzlement, extortion, abuse of power, conflict of interest, favouritism and nepotism. Two types of corrupt practises have arisen in recent times. These are `tenderpreneurism' and `Black Economic Empowerment (BEE) fronting.' `Tenderpreneurism' are individuals who enrich themselves through corrupting the awarding of government tender contracts, mostly based on personal connections and corrupt relationships. `BEE Fronting' is a loophole in the rules governing BEE where qualifying persons in terms of BEE criteria are given a seat on the Board of a company while having no decision-making power in the company, in order to qualify the company for government contracts in terms of BEE ratings.

In another 2009 article Ngamlana called for intervention in respect of corruption in local government. In 2011 when writing on civil society and corruption in government it was stated that the subject of corruption in South Africa's municipalities had attracted a fair amount of attention. Ngamlana insists that `corruption', is a feature of South Africa that cannot be denied. The fact is that South Africa has a number of anti-corruption legislation and bodies in place e.g. The Prevention and Combating of Corrupt Activities Act (No 12 of 2004), the Hawks, the Public Prosecutor, the South Africa Police Services etc. However, the corruption that becomes public knowledge may be limited but the annual Auditor General reports on the provinces and municipalities are a pointer to the real extent of corruption's impact in South Africa.

In 2009 Thembi Mabhula spelt out the how corrupt relationships were destroying Small Micro and Medium Enterprises (SMMEs) and Community Based Organizations (CBOs). Thembi noted that many CBOs had low human and material capacity to help carry out their plans. He noted that financial resources allocated by the government to support CBOs and SMMEs often did not reach the intended beneficiaries, but instead landed in the pockets of corrupt officials. Furthermore, Government tenders intended to uplift growing SMMEs and well-established businesses had enriched some municipal and government officials instead. Mabhula added that it is a common practice that many officials owned registered companies and CBOs that are on government database. The corruption occurs when tenders are awarded to their companies, or alternatively to relatives, who own companies, without following the proper tender procedures. That tenders are awarded to nominally to companies willing to pay a bribe. The exchange of livestock like chicken, goats, of bulls and cows typically takes place in `low' volume bribery. In transactions of a substantial monetary gain, corrupt officials using names of registered CBOs can obtain tractors, luxury vehicles or houses. Mabhula adds that in the social interaction in municipalities, corruption is starting to be perceived by communities as the normal way of transacting business. It has resulted in `apathy and despondency in communities where most

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people no longer believe in forming structures to access government funding.' That nepotism is rife; people believe one has to be related to officials in order to access government funding. The recognition of CBOs within a municipality is usually related to expectations of returning a `favour' and relies on how much a CBO leader is networked with government officials. Often officials, including ward councillors, view CBOs as competitors and political threats when they advocate for local development projects and service delivery.

The other concern is that South Africans are carrying the costs of corruption in society. The following are such costs. Macro-fiscal costs include lost revenue from tax and custom levies, licensing fees, traffic fines, and high expenditure as a result of corruption loadings and fronting on State contracts. A second cost is the reduction in productive investment and growth. In this instance the costs of corruption are particularly high for areas in great need of inflows of productive foreign capital. Widespread corruption provides a poor environment that does not attract foreign investment. Corruption however is known to attract investors seeking to make quick profits through dubious ventures. The third sets of costs are those that impact on the public and the poor in particular. This cost diverts resources from their intended purposes and distorts the formulation of public policy and the provision of services. A forth cost is the loss of confidence in public institutions. Once it is the `norm' for services to be `bought' and the consequence is that public officials break the trust and confidence people have in them, a loss in confidence in public institutions sets in.

Thus far South African government interventions against corruption have been more or less ineffective. Public officials are not sufficiently accountable and transparent to the citizens and they appear to be getting away with a lot of punishable acts of impropriety. As with corruption in municipalities and corruption in government departments continues to escalate in South Africa. The efforts to eradicate poverty and transform the country will continue to be undermined. I do not imagine that corruption can be totally eradicated. That is an impossibility given how the human mind functions. However, corrupt practises can be checked and reduced to a level where society does not have to bribe their way before they are rendered services by Government institutions.

8.0 MERITOCRACY IN SINGAPORE

Merriam-Webster dictionary definitions of meritocracy include; `a political philosophy that holds that people should be selected (for office) according to merit'. Another meaning is that `society should bestow power in individuals according to merit'. A further interpretation is `the holding of power in government should be by people selected according to merit'. It has been claimed that in a meritocracy people with a firm vision and skills may aspire to attain the highest levels of their undertaking.

Progress in a meritocratic environment is based on intellectual talent measured through examination or is demonstrated achievement in the field where it is implemented. This paper

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does not dwell on the interesting readings on meritocracy from Confucian to modern day philosophies. Instead I refer to Singapore and People's Republic of China to illustrate what societies can achieve in two to three decades of meritocratic driven developments, and the problems that such societies still battle to overcome.

Singapore has described meritocracy as one of its official guiding principles for domestic public policy formulation. It places emphasis on academic credentials as objective measures of merit. Pravin Prakash (2013) notes that `it cannot be denied that there are fundamental benefits to a meritocratic system that has been indispensable in the rapid rise of Singapore as a prosperous city-state. It is argued that meritocracy advocates fierce competition which pushes people to achieve the best that they can; regardless of class, race or creed they may find success if they get to the finishing line first.'

This is how Singapore looks today. Index Mundi describes Singapore as an island nation with a 2013 population estimate of 5,460,302. Singapore is a highly successful free market economy that enjoys a corruption free environment. It had in 2013 GDP (purchasing power) of $ 331.9 billion (US 2012 $) and GDP (official exchange rate) of US$ 276.5 billion (US 2012 $). GDP per capita (PPP) was $ 61,400 (2012 estimate). Unemployment rate was 1.9%, which is a 2012 estimate. The Gini index of the distribution of family income was 48.1 in 2008 and 47.8 in 2012. In 2012 Singapore's GDP composition by sector was industry 26.8% and services 73.2%.

Although meritocracy has been a positive policy for Singapore there is a current feeling that `Singapore meritocracy has run its course' (2014). In that article proof is offered that in its implementation there was a build-up of high social mobility, competitiveness and ambition that resulted in compassion and public trust. However, almost five decades of independence in 2014, the Singaporean meritocracy has assumed a character that shows elements of low social mobility, anti-competitiveness and entitlements from certain quarters of Singapore society. In other words it has reached the limits of its efficiency. Thus at the time of Singapore's independence in 1966, the Gini coefficient was 0.498 which fell by 18% to 0.422 in 1980 and increased from 1980 to 2013 by 9.7% to a Gini coefficient of 0.463. There is no shortage of opinions on what is going wrong.

In an article titled `50 responses to Singapore meritocracy has run its course', Singapore's citizens reflect on the island nation's current situation viz meritocracy as follows; `Meritocracy would work for the first generation after independence, second at the best. Any longer than that and you get a situation in which the powerful who are in place would want to shore up their positions by replicating themselves through their forbears or their cronies'. Many views pointed to nepotism, cronyism and political domination of the Premier Lee Kuan Yew and the wider family. In political and economic sector of Singapore. Others were of the opinion that wealth and power accumulates, with people at the top creating `better environments' for themselves. There was the challenge of the emergence of an elitocracy, and of `the animal farm' syndrome. Others complained `that it is whom you know and how well you are connected that matters.' The lack of

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social system to care for their people is a cause for concern. Other citizens felt that power was used to preserve corrupt interests was a problem, as established network of old-boys entrenching elitism, national wealth and power monopolizing etc.

The literature on Singapore's meritocracy points to the belief that it was a definite driver for its rapid material development in at least the first two decades. However, without political checks and balances nepotism and cronyism and the absence of a social safety net that takes care of the most vulnerable population, the gains from meritocratic Singapore have begun loose meaning to its citizens. However, what cannot be denied is the material upliftment across society driven by a broad policy driven by meritocracy.

9.0 MERITOCRACY AND CADRE DEPLOYMENT IN CHINA

Index Mundi's China economic overview states that `since the late 1970s China has moved from a closed, centrally planned system to a more market-oriented one that plays a major global role. In 2010 China became the world's largest exporter. China implemented reforms in a gradualist fashion. The restructuring of the economy and resulting efficiency gains have contributed to a more than tenfold increase in GDP since 1978. In 2012 China was the second-largest economy in the world after the USA. The dollar values of China's agricultural and industrial output each exceed those of the USA in the same year; China is second to the USA in the value of services it produces. The government's 12th Five-Year Plan, adopted in March 2011, emphasises continued economic reforms.'

Eric X Li is a venture capitalist and political scientist from the People's Republic of China. He depicts perhaps what professionals in African societies should reflect upon as possible avenues to untangle our continent's developmental aspirations. Li is provocative and rhetorical he rejects the West's models of capitalist multiparty democracies as the only way to run a successful modern nation (My emphasis). Li argues that in the meta-narratives of Karl Marx-Mao Tse Tung Communism failed China. Similarly Li asserts that the Western meta-narrative of the electoral democracy has failed the long-suffering peoples and nations of the developing world.

In a public lecture Li depicts how in just three decades, China was transformed from one of the poorest agricultural countries in the world to its second-largest world economy, as already pointed out above, in which 650 million people were lifted out of poverty in a 30 year period. According to Li central to China's rapid transformation is the Communist Party. Li notes that because of its historical structure, the rest of the world presumes that China is `operationally rigid, politically closed and morally illegitimate', which he states is not the truth. He illustrates in his presentation that `adaptability, meritocracy, and legitimacy are the three defining characteristics of China's one-party system' and narrates how the Communist party `self-corrects' to enact new rules to correct previous dysfunctional policies. Through a number of

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examples Li shows that in China, for three decades political reforms have been continuous and this explains China's rise in a mare 30 years.

Li graphically outlines how the Communist Party is one of the most meritocratic political institutions in the world today. Mobility to the top leadership is a 25 to 30 year career journey through the Party's Organizational Department (POD). The POD is described as a `human resource engine' where graduates are recruited at entry-level positions with performances reviewed once a year and as they rise the Chinese hierarchy they are typically assigned to manage more people in larger geographical areas or a company with hundreds of millions of dollars in revenue. Li points out that by the time party operatives attain certain levels of responsibilities in the Chinese system they have been exposed to managing millions of people and resources way beyond the typical Western political leader. Out of this systematic meritocracy other avenues of Chinese versions of `participation' has evolved. `Pew Research' polls Chinese attitudes to virtually every aspect of the country on a continuous basis. This is what informs domestic policy adjustments in China.

Li states that this is not to state that China does not have problems. To the contrary China faces immense challenges in pollution, food safety, population issues, corruption, intolerance of religious and ethnic groups etc. The conclusion of Li's presentation is that `*the significance of China's example is not that it provides an alternative, but it demonstration that alternatives exist'*. (My emphasis)

10. THE PROGRESSIVE PROFESSIONAL FORUM

In 2013 Karl Gernetzky reported the formation of the Progressive Professional Forum (PPF) that aimed at attracting and galvanising card carrying professionals in the ANC. The forum was conceptualized as a `think tank.' It was launched in August 2013. It was reported that it aims were to ` encourage professionals to return to the ANC, attract professionals, and reassert the intellectual capital which sometimes lies dormant within the ANC'. In an article by Lefifi another dimension of the planned PPF was stated as `giving better qualified, card-carrying members of the ANC more of a voice in the party.' Furthermore, it is claimed that the presence of the PPF would allow unelected ANC professionals to "contribute" to the party. In addition the PPF was "*concerned by the seeming withdrawal of progressive professionals in the public debate*" (My emphasis).

The PPF Secretary General, Siphile Buthelezi in August 2013 gave a clearer meaning to the forum's intensions. It was stated that the PPF `comprises professionals, entrepreneurs, intelligentsia and academia who are aligned to the progressive movement, and who aspire to progressive ideals such as those in the Freedom Charter, in the preamble of the Constitution of the Republic of South Africa.' It was clarified that the `PPF was not formed by the ANC….it was time that professionals ensured that the better South Africa for all is actually realised now'. The SG conceded that except those involved through charities, *professionals in South Africa were*

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not engaged in the body politics of the country. That it was time for the professionals to play a role in the running of the state and in assisting the government' (My emphasis).

A description of the proposed PPF structures were a mirror reflection of government clusters in 2013. When launched by President Jacob Zuma, among other utterences, was that the President wanted to hear the opinions of the PPF in `all major developments and processes. We want to hear your interventions on the economic transformation of our country. We want to hear you on political developments'. The President added that … `trust you will debate amongst yourselves robustly on how you are going to help this country to advance democracy and take transformation forward.'

11. DISCUSSION: A SUGGESTED AGENDA

This discussion wishes to reflect on service delivery challenges highlighted above by the selective concentration on cadre deployment and corruption, the two factors that have a high impact on the transactions of service delivery.

Thus so far I have depicted a situation of service delivery protests in the light of the challenges faced in the planning and implementation of infrastructure. I have argued that service delivery has technical and political issues it needs to overcome. The PICC correctly identified the technical problems that require to be harmonised. However, it is silent on the problems resulting from the political aspects of the challenges.

Scholars and lay critics have argued that ANC's policy of cadre deployment is at the root of the political problems of service delivery at municipalities. That this policy places people who are often not technically qualified or experienced in charge of the various facets of a municipality's or public entity's management. Corrupt relationships are encouraged by this policy. The Auditor General presents South Africa's the extent of the financial consequences of the problem annually.

The examples of Singapore and People's Republic of China points out that meritocratic cadre deployment over a period of time will place the people with the right training, qualifications and experience in management of institutions and address society's challenges. That meritocratic leadership has created employment opportunities and lifted poverty for millions in China and Singapore

I argue herein that in the founding of the Progressive Professional Forum in 2013 from within members of the ANC is a positive development. It is for the following two reasons that I foresee the PPF as a vehicle those considered opinions may be accepted by the ANC.

The first is that the ANC is known to strongly react to criticism by professionals and business leaders. This was noted by Lefifi in 2014. In 2014 Prince Mashele and Mzukisi Qobo published

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`The Fall of the ANC; What Next?' which is a critique of the ANC that re-enforces Lefifi's brief notes. However, it is unlikely for the ANC to perceive of the PPF as `outsiders', since members of the PPF are first and foremost card carrying ANC members. The question is to what extent membership of the PPF will be critical of failed policies of the ANC and push for a reformist agenda.

The second is that the paper has argued that meritocracy adopted as a national culture and enshrined as political party policy can and does place the people with the right skills, education, qualifications or experiences to manage political and economic entities commensurate with their standing in the hierarchy of responsibilities as in the case of China. A `professional' by definition is a person who is trained, qualified (through some examination or more) and is experienced in his/her area of qualification. Therefore, it can be argued that the PPF membership being `professionals, academics, intellectuals and entrepreneurs'' is by definition a meritocratic organisation.

Suggestions for research into a service delivery agenda is the last part of this discussion. It is argued from the overwhelming evidence that the ANC policy of cadre deployment has been one the most counterproductive policy decision impacting on municipality service delivery as elsewhere in the Public sector. However, it was noted that the launch of the Progressive Professional Forum amongst professionals within the ANC was potentially a positive development, if the ANC culture can accommodate and hear the PFF out.

Specific agenda suggestions for the PFF to research and formulate policy include the following; Firstly, that the PPF investigates the reasons why professionals are not actively part of the South Africa body politics and in the process determine the political and technical dilemmas and conflicts professionals face in working for Government programmes and projects. Secondly, that the PPF investigates cadre deployment and quantify its repercussions on service delivery in South African municipalities. Thirdly, that the PPF investigates the education, qualifications and experiences of deployees with regards to the jobs they hold and with respect to the terms of reference for those jobs. Fourth, that the PPF engages tertiary or private institutions that offer tailor made short courses for the training of elected leaders. Fifth, that the PPF studies meritocracy in general, meritocracy best practice case studies and the mechanisms for the introduction and sustaining meritocracy as ANC culture and policy.

The purpose of the above suggested agenda is that for South Africa to transform and provide its citizens with basic infrastructure and quality of life, it will require the ANC to deploy meritocratic cadres in all critical decision making bodies in society where professional opinion and input is valued. For the built environment professional it may mean joining and vigorously supporting bodies such as the PPF or their equivalents in other political bodies. It is to do with professionals raising the levels of awareness, education and being innovative. It is all about evolving South African solutions for the challenges the country faces not only in service delivery but in all facets of development.

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I can conclude that the PPF is the kind of organization that the ANC requires for an injection of professionalism in the reflection of its culture, policies and the way it conducts business that have been counterproductive in the transition to the `ideal South Africa' that its population yearns for.

12.0 CONCLUSION

I have depicted the situation of service delivery protests between 2007 and 2012 in the light of the challenges faced in the planning and implementation of infrastructure in South Africa. I noted that the Government through the PICC in 2012 was aware of the drawbacks of infrastructure delivery and had articulated what it saw as actions required for overcoming infrastructure delivery challenges. However, I argued that even if all the Government institutions were to align and function as mandated that there would still be obstacles to the delivery of infrastructure.

It was pointed out that there was concern expressed in many studies and reports relating to corruption in municipalities. Furthermore, that corrupt relationships was grooming socially undesirable transactional relationships between Government and its people but is an on-going concern of the Auditor General and many South Africans. It is argued from the overwhelming evidence that the African National Congress policy of cadre deployment has been one the most counterproductive policy decision impacting on municipality service delivery as elsewhere in Government.

A brief outline of Singapore and the Peoples Republic of China showed that if the leading political parties self-adjust by re-writing their unattainable policies and seeks policies and governance modalities that produce results then there is no reason why South Africa cannot be transformed into the potential that lies within. The emphasis for both countries was the pursuit of meritocracy in its political structures.

It was noted that the launch of the Progressive Professional Forum amongst professionals within the ANC was potentially a positive development, if the ANC can accommodate and hear the PFF out. A service delivery research agenda was suggested for the PPF that would result in concrete answers as to why professionals have not engaged in the body politics of South Africa and to explore avenues of meritocracy in policy, transactions and implementation.

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HISTORICAL OVERVIEW OF BUILDING ENERGY EFFICIENCY IN GHANA

Emmanuel Adinyira[1], Felix Quarcoo[2] and Michael Nii Addy[3]

Abstract

Historically, building energy efficiency in Ghana has evolved through several paradigms and fragmented un-sustained policies. This paper presents a historical overview of building energy efficiency in Ghana. It attempts to systematically bring to the fore policies implemented, successes achieved, lessons learnt and the views of various key actors through semi-structured interviews. From the late 80's, efforts have been made to boost the energy sector's resilience to energy supply deficiencies with the aim of improving energy efficiency. Diverse efforts have been expounded by key players such as the Ministry of Energy, Energy Commission, Energy Foundation and the Energy Centre of Kwame Nkrumah University of Science and Technology in Kumasi all in an attempt to provide pragmatic energy efficiency policies and regulations for the country. A critical analysis of the various Legislative Instruments and Energy Efficiency policies of Ghana largely points to interventions at the operational phase of buildings. Ghana has pioneered energy efficiency interventions like household appliance standards in Africa, with labels and efficiency standards for energy consuming products. Besides achievements in household appliance standards, the National Building Code is silent on energy efficiency standards for buildings. The next step in the country's effort to improve on its energy efficiency will be to focus much attention on developing some key energy standards for its building construction industry. This will in no doubt give its energy efficiency improvement efforts some more impetus as evident from other countries.

Keywords: Building, Energy Efficiency, Ghana

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1.0 INTRODUCTION

Energy is crucial to sustainable development and poverty reduction because it influences all aspects of development. The UN Millennium Development Goal of eradicating extreme poverty, hunger, health, equality and environmental sustainability by 2015 will not be achieved unless substantial progress is made in improving the quality and quantity of energy services [Modi et al. , 2005; Gboney, 2008; IEA, 2010,].The link between energy and the Millennium Development Goals (MDGs) has been discussed extensively in the literature (Modi et al., 2005; Gboney, 2008; IEA, 2010) and energy poverty is acknowledged as undermining achievement of the MDGs. The energy sector nowadays faces significant challenges that are expected to become even more acute in the upcoming period. The current energy trends as well as the related carbon emissions raise great concerns about the “three Es”, i.e. environment, energy security and economic prosperity as defined by the IEA (International Energy Agency). Energy supply has not been able to meet the demand in Ghana and thus the need to resort to load shedding exercises at various periods (Ahenkorah-Ofosu, 2006; Gboney, 2008; Essah, 2011).

Energy contributes to a virtuous cycle of human, economic and social improvements that are essential to sustainable development in developing countries [See Fig. 1]. Sufficient supplies of clean energy are the basis for raising standards of living, improving the quality and quantity of human capital, enhancing the business and natural environment, and increasing the efficiency of government policies (Birol, 2007; IEA, 2010). Energy is thus vital to providing an array of necessary services, but the nature of its contribution is not fixed. It is possible to alter the end-use devices, methods, infrastructure and behaviour that deliver these services to become more energy efficient or to use alternative types of energy. [Abbasi & Abbasi, 2010].GDP growth is the fundamental driver for energy demand. Several reports have sought to indicate the correlation between energy use and growth directly or indirectly as a complement to other input factors of production (Lee, 2005; Wolde-Rufael, 2006, 2009; Eggoh et al., 2011).Governments in developing countries often have interpreted this to mean “more energy, better economy”. Ghana as a country is rich in energy resources; oil, gas and renewable energy, and is an important energy exporter to its neighbours. But in parallel, this same country particular suffers from very severe energy poverty. The country’s energy challenges are quite similar to that of many developing countries. The well-known, shared justifications for energy efficiency are valid in Ghana, too. Energy efficiency contributes to energy security, competitiveness and reduces

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impacts on the environment. Energy efficiency will contribute to raising the standard of living, by reducing energy bills, and making access to energy more affordable and easier to attain, both in urban and rural areas (*ECOWAS Energy Efficiency Policy (EEEP), 20)*. As the International Energy Agency (IEA) indicates, energy investment has shown a decaying tendency during this period, thus slowing the development of new efficient resources and technologies (WEA, 2000).

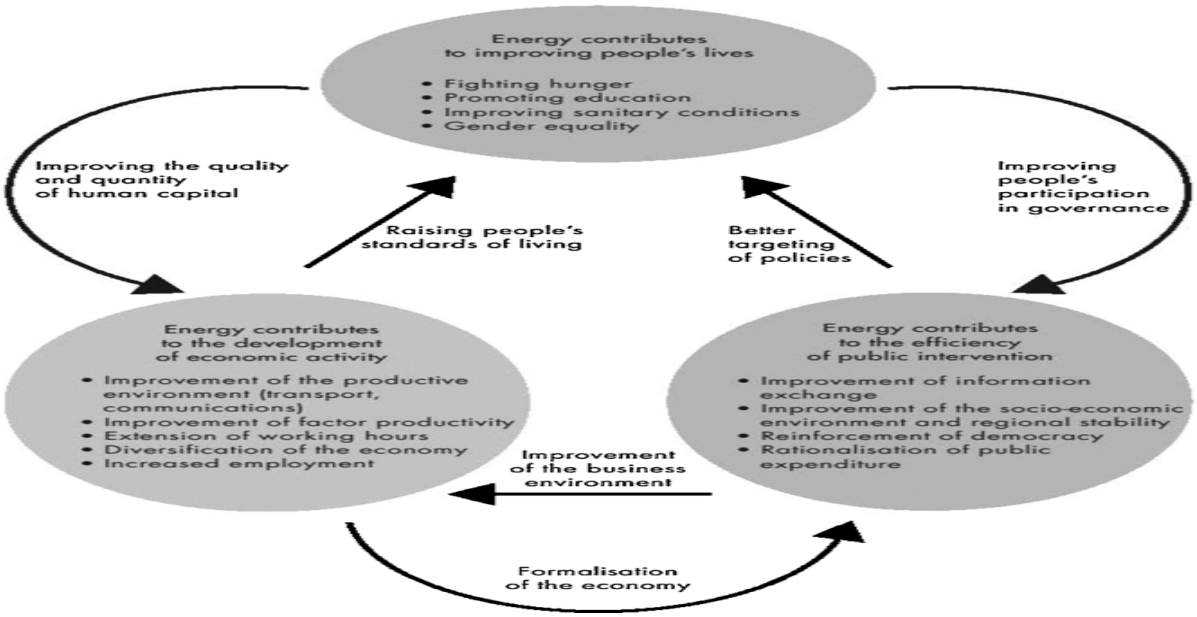

Figure 1: Links between energy and human, economic and social development.

Source: Kaygusuz [2012]

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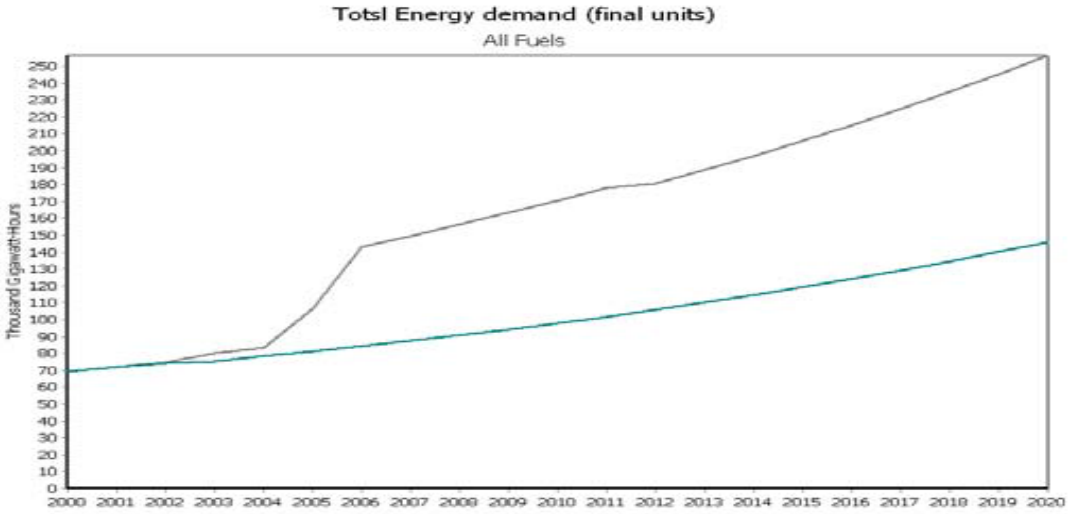

Figure 2: Projected Total Energy Demand by the Economy up to year 2020

Source: (Ahenkorah-Ofosu, 2006)

Demand for energy is growing exponentially in developing countries due to rapid population growth (especially in Africa) and rapid economic expansion. Nearly double in primary energy use, much of it inefficient, by developing countries in the next two decades is projected. As a result of this growth, developing countries will account for 50% of primary energy use and 52% of energy-related CO2 emissions by the year 2030 (Asaduzzaman et al., 2009; Venkataraman et al., 2010).In Ghana, the projected total energy demand by the economy to meet the Middle-Income Goal [See Fig. 2]. Human energy consumption is currently an important issue to address because of the scarcity of resources, energy price increases, and identified environmental problems (Uri, 1995; Ghoshray & Johnson, 2010). Electricity consumption in Ghana is estimated to be increasing by 10% per annum due to the demand from the growing population. However, current sources of production (hydro and thermal facilities) generate only 66% of the current demand (Essah, 2011). A striking observation that has been made in the energy sector is the rapid expansion in the power demand of the residential sector by 23% in 5 years from 1,585GWh (26%) in 2000 to 1,957GWh (37%) in 2005. In contrast the share of power consumption in the industrial sector, which includes agriculture reduced by 37% from 4,026.4GWh (67%) in 2000 to 2,542.6GWh (49%) in 2005**.** It is trite knowledge that any economy where residential sector is taking a bigger percentage of the energy than the industries is in for trouble, since the residential sector whose contribution to GDP is minimal is

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subsidized by the other sectors (Ahenkorah-Ofosu, 2006). One of the key proposals by the Ghana Energy Strategy Plans is "Ensuring that energy is produced and supplied in a form that has no adverse health, safety and environmental impact" (Essah, 2011). Several interventions have been seen as the way to remedy the ever growing demands for energy and promoting efficient use of energy and hence reduce CO2 emissions as priority to create a sustainable world. This paper attempts to recount or offer a historical overview of building energy efficiency in Ghana. It presents an overview of building energy efficiency in Ghana from the beginning of the energy crisis and reveals the emerging developments in the Ghana's energy efficiency story. Information for the paper was gathered through an extensive assessment of various energy efficiency programmes, a review of published literature on Ghana Energy Efficiency situation and also through semi-structured interviews with various stakeholders like the Energy Commission of Ghana, Energy Foundation, Ministry of Energy (MOE) and Energy Centre, KNUST.

2.0 BUILDING ENERGY EFFICIENCY IN GHANA

Throughout the progressive era and in the decades since, an eagerness to define important public issues as questions of efficiency has been a common strategy. Thus it is not surprising to see efficiency reappear at the centre of today's energy debate. Ghana, as a member of the United Nations Framework Convention on Climate Change, is obliged to reduce emission of greenhouse gases to protect globe environment and to promote sustainable development of the world. Energy efficiency in buildings has become a key factor that has a great impact of energy security, optimization of energy structure, energy efficiency improvement and Green House Gas (GHG) emission reduction. Other countries may have similar situations, but the extent of new building construction makes Ghana's case unique. It provides not only a major opportunity to 'grow out' of much of the problem, but also a danger, if not addressed, of locking in enormous energy waste and inefficiencies for future generation [World Bank, 2001]. In July 2006, the Ghana government released its Strategic National Energy Plan on Energy Conservation in the Mid- to Long-term, with its focus on reducing Ghana's GDP energy intensity by 20%, as well as a reduction in the total emissions of pollutants by 20% below the current level. In Ghana, energy efficiency initiatives started since the mid-1980s. In 1998, the country started some feasibility study on Energy Efficiency and Performance Contracting with the main objective of exploring the role of independent organizations - such as Energy Service Companies (ESCOs) - using performance contracting approaches, to promote energy efficiency and cleaner production

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(KITE, 1999;Ahenkorah-Ofosu, 2006). Other studies which were done in the bid to promote energy efficiency in buildings are as follows;

- 1998/1999 Appliance Ownership Study
- 2000 RAC Penetration & Efficiency Studies
- 2001 Energy, Poverty & Sustainable Livelihoods Study
- 2003 Household Energy Consumption Profile Study
- 2003 CFL Penetration Study

3.0 POLICIES SUPPORTING ENERGY EFFICIENCY IN GHANA

Ghana's dedication to energy efficiency improvement dates back to 1987, when the government initiated an "Industrial Energy Rationalization Program" (EC, 2006a). Since then several other programs have been initiated with the same aim of improving building energy efficiency in Ghana. However, these efforts to date have not yielded any sustainable adoption of cost effective energy efficiency practices in Ghana, owing to a number of barriers in the Ghanaian energy market (MoEn, 2010).

Ghana with the aim to integrate Renewable Energy (RE) and Energy Efficiency (EE) development into the energy sector reforms, established two regulatory agencies in 1997, namely, the Energy Commission (EC) and the Public Utilities Regulatory Commission (PURC). The Energy Commission was established by an Act of Parliament (Act 541) to recommend the development and utilization of Ghana's indigenous energy resources, through the preparation of a strategic national energy plan. The second regulatory agency, the PURC, was also established by an Act of Parliament (Act 538) to be responsible for price and quality of service regulation. A third institution is the Energy Foundation (EF), which was, created in 1997 as a Public-Private Partnership institution. The primary aim of this institution is to focus on the promotion of energy efficiency development. The Foundation also specializes in providing energy solutions, particularly for industrial and residential consumers (Energy Commission, 1997; Gboney, 2008; Energy Commission, 2006a).

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The establishment of the three agencies as part of the reforms in the energy sector, culminated in the country's Ministry of Energy (MOE) losing some of its regulatory and operational functions, even though it is still responsible for policy formulation for the energy sector. Over the past few years, Ghana has been advancing with respect to legislation on energy efficiency (see Table 1), aiming to propose, implement and monitor effective measures for the rational use of electric energy.

Table 1: Legislative Instruments regarding energy efficiency in Ghana

Year	Legislative Instrument (LIs)	Objectives
2005	Energy Efficiency Standards and Labelling Regulations, 2005(LI 1815)	Regulations apply to non-ducted air conditioners or self-ballasted fluorescent lamps manufactured in Ghana or imported for use in Ghana, are obliged to display a label which indicates the energy efficiency rating of the product before the first retail sale.
2008	Energy Efficiency(Prohibition of Manufacture, Sale or Importation of Incandescent Filament Lamp, Used Refrigerator, Used Refrigerator-Freezer, Used Freezer and Used Air-Conditioner) Regualtions,2008(LI 1932)	Regulation apply to the import, offer of sales or distribution manufacture of incandescent filament lamp, used refrigerator, used refrigerator-freezer, used freezer and used air-conditioner in the country
2009	Energy Efficiency Standards And Labelling (Household Refrigerating Appliances) Regulations, 2009(LI 1958)	Regulation provide for the enforcement of minimum energy efficiency for household refrigerating appliances prescribed in these Regulations and measured in accordance with the Ghana Standard the GS IEC 62552: 2007; and the labelling of household refrigerating appliances
2010	Energy Efficiency Standards And Labelling (Household Refrigerating Appliances)(Amendment) Regulations, 2010 (LI 1970)	Is an amendment of Regulation 3 of L.I. 1958 , which shows the minimum energy efficiency star rating in accordance with the Ghana Standard GS IEC 62552:2007

Source: (Energy Foundation, 2005; Energy Commission, 2013)

Government policies are key to ensuring that the energy sector advances sustainable development. There are many policy domains where policies influence how and how much energy is produced, converted, transported, distributed and used. Ensuring that energy systems develop in a way that best supports and accords with sustainable development requires communication and co-ordination among all relevant policy areas at all levels of government(IEA, 2008; IEA, 2010).The challenges faced by energy efficiency programmes in the developed

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countries are well known, and examples of such challenges are manifold in developing countries (Sarkar and Singh, 2010)**.**Ghana has introduced active polices on energy efficiency for lighting efficiency and appliances standard and labelling (UNDP, 2010). Promoting these policies will not necessarily lead to a reduction in energy use and hence reduced CO2 emissions. It will, however, save consumers money, promote a more efficient and prosperous economy, and allow the move towards fossil-free energy future. It is a means not an end.

4.0 SUCCESS ACHIEVED TO DATE

Recognizing the very important role energy efficiency and conservation plays in ensuring security of energy supply, Ghana has pioneered standards for household appliances in Africa. The country developed Energy Efficiency Standards and Labels for Refrigerating Appliances similar to that for Room Air Conditioners and Energy Saving Lamps. The measurement of energy efficiency initiatives is growing and accumulating some positive results. There are, however, several features in the Ghana energy market which inhibit its effectiveness, due to a series of obstacles and imperfections (Gboney, 2008).

According to the experience of developed countries, market transformation initiatives to improve the efficiency of residential appliances have been highly beneficial (Meyers et al., 2003).Labelling and standards, efficiency regulation and market surveillance measure adopted with similarity to the European scheme is expected to lead to a significant reduction of the electricity consumption required and the investment is expected to be highly cost-effective. This programme is likely to reduce the amount of public subventions which are required to provide access to electricity for low-income households (UNDP, 2010). Also the “Refrigerating Appliance Market Transformation Project” has also been initiated to reduce the energy consumption of refrigerating appliances from the current average of 1,200kWh to 600kWh per appliance per annum with the Legislative Instrument LI 1958 [The Energy Efficiency (Refrigerating Appliances) Regulations, 2009] is also in place to provide the legal backing required.

The Government has also installed Automatic Capacitor Banks (ACB) at selected government institutions to reduce Government expenditure on electricity. The pilot project implemented in six government institutions including the Ministry of Defence, Korle-Bu Teaching Hospital, the Office of the President, Food and Drugs Board, Accra Sports Stadium and Parliament House

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has resulted in the reduction of power consumed from 11,743kVA to 9,889kVA. This translated in monetary terms to a total savings of about GH¢39,145 a month or GH¢469,740 per annum, Government is expected to extend this to other public buildings while encouraging the private sector to undertake similar measures **(**MOE, 2012).

5.0 LESSONS LEARNT TO DATE

Policy has been targeting improved energy efficiency in buildings for at least 35 years. Despite policy success stories, energy use in buildings continues to grow. In 2010, energy services delivered in residential and commercial buildings accounted for about one third of worldwide final energy demand and carbon dioxide (CO2) emissions (IEA, 2010). The idea of practicing sufficiency as the solution to the moral, social and environmental problems of 'excessive' consumption is long-standing in Ghanaian life style, as is the advocacy of efficiency as the solution to resource shortages. Promoting efficiency without curbs on consumption (through regulation or taxation) will not tackle the problem of reducing CO2 emissions. The goal should be less carbon dioxide emissions and not less energy use; ultimately energy growth needs to be decoupled from CO2 emissions. The constant generation of power, by thermal plants (that uses light crude oil for fuel) defeats this purpose as it contributes significantly to CO2 emissions, and hence global warming (Essah, 2011).Significant progress has been made in Ghana and particularly at operational energy phase of building with regard to efficiency standard of appliance and lighting. Standards and labelling programmes are essential elements in any government's portfolio of energy efficiency policies and climate change mitigation programmes. Labels play the public education part and deliver the efficiency information to the consumers and standards transform the market by eliminating the most energy inefficient products**.** With provision for economic reward for those who opt for this type of efficiency project. New schemes like energy labels take time to gain general acceptance but once understood, these can be repeated in many product groups.

Although the existing barriers (building energy efficiency) in developing countries are similar to developed countries(UNIDO, 2011),the lack of adequate policy frameworks, fragile economies, poor energy infrastructure, among others, makes the existence of these barriers more pronounced in developing regions (Compton, 2011). Ghana faces the challenge of balancing its development-driven increase in building energy demand. While building energy regulations exist in almost all developed countries more and more developing countries are currently introducing

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such legislation (Deringer et al., 2004; UNEP, 2010).Call for stronger standards for new buildings are desirable as soon as possible in order to avoid locking in more inefficient buildings. Also effort to increase compliance with energy standards to govern envelopes and HVAC systems in new buildings as practiced in most developed countries like USA, China and in Europe (CPI Report, 2013). Reducing the rising demand for electrical services through both technological and non-technological (behavioral) approaches and shifting the supply of the remaining energy demand to renewable energy, with further refine existing legislative instruments to be refocused or complemented with additional policy is the right direction in building energy efficiency.

6.0 CONCLUSION AND RECOMMENDATIONS

Energy enables innumerable services capable of improving human, social, economic and environmental conditions in developing countries. While policy has made some progress in building energy efficiency, there is a broad consensus that much more is necessary to meet MDG goals on energy sustainability. A leap from the current minimal energy services situation directly to high efficient energy economy can be facilitated through Energy Efficiency. However, any leap requires a stable energy policy framework. In establishing policy guidelines and implementing efficiency measures, the long experience of developed countries should be useful. This experience shows that, the best energy saving results is the result of many measures in parallel: legislation, financing and information are the three pillars required. Measures concerning energy consuming products are a good starting point. New schemes like energy labels take time to gain general acceptance but once understood, can be repeated in many product groups should be adopted. Energy efficiency in buildings is important not only because it represents the lion's share of energy use, but also because of the related social, health and employment impacts. Besides, it is a widely used instrument in most developed countries to control energy consumption in building. Whilst need for Energy efficiency building standard and codes inserted in the National Building Regulation are the most common policy measure in most countries, there is also needs to develop the capacities of construction professionals and other self-builders through training, education and information dissemination. Also, Ghana's energy efficiency regulations and policies must be administered at levels ranging from the highest level of state government down to municipal and district level, with sole purpose to integrated and build a consensus approach since the local dimension of building energy efficiency is very important as citizens and industries take the final decisions on energy use.

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Also further study into Embodied Energy of building energy efficiency in the Ghanaian context need to be accessed. Promoting the use of building energy regulations for energy conservation and efficiency in developing countries through adequate implementation of the proposed solutions to the identified barriers in this study is therefore required.

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CONSTRUCTION HEALTH AND SAFETY RISK MANAGEMENT

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Abstract

Millions of people in the European Union (EU) are injured at work, or have their health seriously harmed in the workplace every year. This incident calls for a risk assessment because it is the key component to healthy workplaces. Risk assessment is a dynamic process that allows enterprises and organisations to put in place a proactive policy of managing workplace risks. Hence, the present objective of the current study is to outline how occupational health and safety (OHS) risk management is carried out to minimize risk in construction sites. The approach to OHS prevention is through risk assessment. The study is conducted with reference to existing theoretical literature, published and unpublished research. The study is mainly a literature review survey on OHS risk management. Findings from the study reveal that proper risk assessment requires employers to ensure that all the relevant risks are taken into account. They should also check the efficiency of the safety measures adopted, document on the outcomes and review the assessment regularly to keep it updated. Five approaches to risk assessment were found to be identification of hazards and those at risk, evaluation and prioritising risks, deciding on preventive action, taking action and monitoring, and reviewing of the assessment. Engineering and administrative control measures as well as the use of personal protective equipment (PPE) were found to be the methods of hazard control. The study explores OHS risk management. Steps are taken in risk assessment to protect the H&S of employees who may be adversely affected by the activities in the construction industry. It presents a robust background on OHS risk management.

Keywords: Construction; Health and safety; Risk management

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1.0 INTRODUCTION

The construction industry in Britain accounts for only about 5% of the employees but contributes 27% of fatal injuries to employees and 10% of reported major injuries (Health and Safety Executive (HSE), 2013). 2010 Statistics show that most fatal falls occurred in the construction industry. There were 1913 reported major injuries to employees in 2012/13p, as compared to an average of 2 815 over the previous five years. The corresponding rates of major injury per 100 000 employees were 156 in 2012/13p and an average of 192 (HSE, 2013).There have been significant reductions in the number and rate of injury over the last 20 years or more. Nevertheless, construction remains a high risk industry. Occupational health is often overlooked in the construction industry as it concentrates on accident prevention. The construction industry has a high incidence of occupational ill health which can have a devastating effect on individuals (Construction Development Management (CDM), 2007). According to CDM (2007) efforts have focused more on safety hazards rather than on workplace hazards resulting in ill health issues. A hazard is anything, including work practices or procedures that have the potential to harm the health or safety (H&S) of a person or to cause damage to property (Home and Community Care (HCC), n. d.). Accidents and ill health can ruin lives and affect employer's construction work if output is lost, machinery is damaged, insurance costs increase or employers have to go to court (HSE, 2011). Employers are legally required to assess the risks in their workplace, so that they can put in place a plan to control the risks (HSE, 2011). Risk is the chance of the injury or damage happening, and how severe the injury or damage might be (HCC, n. d.).Employees have a right to be protected from harm caused by a failure to take reasonable control measures by their employers (HSE, 2011). In risk assessment, steps are taken in this process to protect the H&S of employees who may be adversely affected by works, process and or events being undertaken at the construction sites. It is mandatory for all employers to conduct assessment to control risk in their workplaces and comply with H&S. A risk assessment is simply a careful examination of what, in your work, could cause harm to people, so that you can weigh up whether you have taken enough precautions or should do more to prevent harm (HSE, 2011). Risk assessment is also defined as making a judgement about how dangerous a risk associated with a hazard is. This must be done in consultation with the people who may be exposed to the risk (HCC, n. d.). An occupational health and safety management system (OHSMS) provides a framework for managing your occupational health and safety responsibilities so they become more efficient and more integrated into overall construction operations (Health and Safety Management Systems (HSMS), 2004). The appropriate preventive measures of risk assessment are not likely to be identified or put in place if H&S management approach is not carried out well or not done at all (European Agency for Health and Safety at Work (EAHS), n. d.). This paper presents an outline of how OHS risk management is carried out to minimize risk in construction industry. It begins with a discussion with the typical OHS issues in the construction industry and duties of the employer, followed by risk assessment and methods of hazard control, and finally, management of occupational health risk in the construction industry.

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2.0 CONSTRUCTION INDUSTRY AND OCCUPATIONAL HEALTH AND SAFETY

A risk assessment is an important step in protecting construction workers as well as complying with the law. It helps employers to focus on the risks that really matter in their workplace mostly beginning with the ones with the potential to cause real harm (HSE, 2011). The law does not expect employers to eliminate all risk, but are required to protect people as far as reasonably practicable (HSE, 2011). Managing occupational health goes beyond undertaking pre-start health checks, providing first aid and site welfare facilities. It involves organisations and employers having effective system of managing occupational health risks as well as compliance with H&S legislation (CDM 2007). Occupational Health and Safety (OHS) legislation requires that all foreseeable hazards are identified and the risks arising from these hazards are eliminated or controlled, Australian business consulting and solutions (ABCS, n. d.). The OHS objectives include:

- To secure the health, safety and welfare of employees and other persons at work;
- To eliminate, at the source, risks to the health, safety or welfare of employees and other persons at work;
- To ensure that the H&S of members of the public is not placed at risk by the conduct of undertakings by employers and self-employed persons; and
- To provide for the involvement of employees and organisations representing those persons, in the formulation and implementation of health, safety and welfare standards (Capital Development Guidelines (CDG), 2011).

2.1 Typical health issues in the construction industry

Occupational health issues are not always and immediately visible but can have the same devastating impact as accidents and injuries, sometimes causing prolonged and long term health problems. Some of the health problems associated with work in the construction and building industry include (CDM, 2007):

- Musculoskeletal disorders including back pain usually from manual handling;
- Noise- induced hearing loss;
- Respiratory and breathing problems including asthma from exposure to asbestos, dust, silica and other hazardous substances;
- Skin diseases including dermatitis from exposure to chemicals, paint, cement, bitumen, asphalt and other hazardous chemicals used in the industry;
- Hand arm vibration syndrome resulting from frequent operation of hand held power tools; and
- Occupational stress due factors such as work pressures, work load, the risky nature of the job, job insecurity.

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2.2 Duties of the Employer

The duty of the employer is to provide and maintain for employees a working environment that is safe and without risks to health as reasonably practicable.

- Provide or maintain plant or systems of work that are, so far as is reasonably practicable, safe and without risks to health;
- Make arrangements for ensuring, so far as is reasonably practicable, safety and the absence of risks to health in connection with the use, handling, storage or transport of plant or substances;
- Maintain, so far as is reasonably practicable, each workplace under the employer's management and control in a condition that is safe and without risks to health;
- Provide, so far as is reasonably practicable, adequate facilities for the welfare of employees at any workplace under the management and control of the employer; and
- Provide such information, instruction, training or supervision to employees of the employer as is necessary to enable those persons to perform their work in a way that is safe and without risks to health (CDG, 2011).

The employer must ensure that employees are not exposed to risks to their health or safety arising from the conduct of the undertaking.

- Monitor the health of employees;
- Monitor conditions at any workplace under the employer's management and control;
- Provide information to employees (in such other languages as appropriate) concerning H&S at the workplace, including the names of persons to whom an employee may make an enquiry or complaint about H&S;
- Keep information and records relating to the H&S of employees; and
- Employ or engage persons who are suitably qualified in relation to OHS to provide advice on H&S issues to employees (CDG, 2011).

3.0 RISK ASSESSMENT

In practical terms, a risk assessment is a thorough look at your workplace to identify those things, situations, processes, etc. that may cause harm, particularly to people. After identification is made, the employer evaluates how likely and severe the risk is, and then decides what measures should be in place to effectively prevent or control the harm from happening (Canadian Centre for Occupational Health and Safety (CCOHS), 2009). The following should be followed:

- Identification of hazards;
- Analyzing or evaluating the risk associated with that hazard; and

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- Determining appropriate ways to eliminate or control the hazard (CCOHS, 2009; (ABCS, n. d.).
- The following are the time when a risk assessment should be carried out:
- When there is uncertainty about how a hazard may result in injury or illness;
- When the work activity involves a number of different hazards and there is a lack of understanding about how the hazards may interact with each other to produce new or greater risks; and
- When changes at the workplace occur that may impact on the effectiveness of control measures, New Wales government (NSW Government, 2011).

3.1 Importance of risk assessment

Risk assessments are very important because they form an integral part of a good OHS management plan. They help to:

- Create awareness of hazards and risks;
- Identify who may be at risk (employees, cleaners, visitors, contractors, the public, etc.);
- Determine if existing control measures are adequate or if more should be done;
- Prevent injuries or illnesses when done at the design or planning stage; and
- Prioritize hazards and control measures (CCOHS, 2009).

3.2 Goal of risk assessment

The aim of the risk assessment process is to remove a hazard or reduce the level of its risk by adding precautions or control measures, as necessary. By doing so, the employer has created a safer and healthier workplace (CCOHS, 2009).

3.3 Rank or prioritization of risks

There is no one simple or single way to determine the level of risk. Ranking hazards requires the knowledge of the workplace activities, urgency of situations, and most importantly, objective judgment (CCOHS, 2009). Ranking or prioritizing hazards is one way to help determine which hazard is the most serious and thus which hazard to control first. Priority is usually established by taking into account the employee exposure and the potential for accident, injury or illness. By assigning a priority to the hazards, the employer is creating a ranking or an action list (CCOHS, 2009). The following factors play an important role:

- Percentage of workforce exposed;
- Frequency of exposure;
- Degree of harm likely to result from the exposure; and
- Probability of occurrence (CCOHS, 2009).

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3.4 Documentation for risk assessment

There is the need for documentation or record keeping depending on level of risk involved, legislated requirements, and or requirements of any management systems that may be in place (CCOHS, n. d.; HCC, n. d.).

3.5 Approach to risk assessment

Assessments should be done by a competent team of individuals who have a good working knowledge of the workplace. Employees should be involved always include supervisors and employees who work with the process under review as they are the most familiar with the operation (CCOHS, 2009). Proper risk assessment process includes:

- Employers should ensure that all the relevant risks are taken into account (not only the immediate or obvious ones);
- They should also check the efficiency of the safety measures adopted; and
- There should also be documentation on the outcomes of the assessment and review the assessment regularly to keep it updated (EAHS, n. d.).
- The approaches to risk assessment include:

Step 1: Identify of hazards and those at risk;

It is the responsibility of the employer to work out how people could be harmed. When an employee works in a place every day it is easy to overlook some hazards.
Employees are supposed to look at what could reasonably be expected to cause harm. This can be discussed with the employers or their representatives. They may have noticed things that are not immediately obvious. There is the need to have a look at accident and ill-health records which often help to identify the less obvious hazards.

Step 2: Evaluate and prioritize risks;

The employer needs to be clear about who might be harmed in each hazard. This will assist the employer to identify the best way of managing the risk by identifying groups of people working in a particular location. The employer needs to identify the type of injury or ill health that might occur. New and young employees or expectant mothers and people with disabilities may be at particular risk. Therefore, they need some particular requirements. Extra care will be needed for some hazards; cleaners, visitors, contractors, maintenance workers etc., who may not be in the workplace all the time; members of the public, if they could be hurt by the construction activities. The employer needs to think about how the construction activities affect his employees and other people present at the workplace.

Step 3: Decide on preventive action;

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The employer will decide on what action to be taken when the hazards have been identified. The OHS law requires the employer to do everything 'reasonably practicable' to protect employees from harm. It is the responsibility of the employer to look at what he is already doing, have a second thought about what control measures he has in place and how the work is organised. Finally, this will be compared with the good practice and see if there is more that need to be done to bring the employer up to standard.
The employer should also consider the following two factors:
Can the hazard be eliminated completely? How can hazards be put under control so that harm is unlikely to occur to any employee?
Improving H&S needs not cost a lot but failure to take simple precautions can cost an employer a lot more if an accident does happen. Employees should be involved so that an employer can be sure that what he proposes to do will work in practice and will not introduce any new hazards.

Step 4: Take action;

The employer should put the results of the risk assessment conducted into practice by writing down the results in relation to OHS and share them with his employees. Risk assessment of OHS must be suitable and sufficient to show that a proper check has been carried out. Therefore, the employer must involve the employees or their representatives in the process and ask who may be affected so that significant hazards will be dealt with. By taking into account the number of employees who may be involved and give reasonable precautions to minimize the risk.

There is the need for the employer to take a good plan of action and must prioritize and tackle the most important risk first.
This includes a mixture of different actions such as:
Easy improvements that can be done quickly, perhaps as a temporary solution until more reliable control measures are put in place; long-term solutions to those risks most likely to cause accidents or ill health; long-term solutions to those risks with the worst potential consequences; arrangements for training of employees on the main risks that remain and how they are to be controlled; regular checks to make sure that the control measures stay in place; and clear responsibilities – who will lead on what action to be taken and when?

Step 5: Monitor and review;

The employer needs to review the OHS risk assessment on regularly basis to make sure there is no draw backs, whether there has been any change or an improvement on the previous assessment that need to be made (HSE, 2011; CCOHS, 2009; HCC, n. d.; EAHS, n. d.).

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3.6 Communication during risk assessment

Key stakeholders in the risk assessment process should be informed on the following:

- What the hazard and the risk is;
- What a risk assessment is and the purpose of doing one;
- Who will do the assessment;
- Who else will be present;
- When it will occur;
- What it will involve; and
- Potential outcomes of the assessment (HCC, n. d.).

3.7 Management of occupational health risk in the construction industry

Managing occupational health risks is placed on the employer under the management of H&S at Work Regulations 1999. To meet these legal requirements as well as improving the organisation's H&S performance and ultimately reduce risks and costs. The employers should have the following in place:

- H&S policies and procedures with practical arrangements for managing occupational health risks;
- Provision of employee awareness training on manual handling, control of substances hazardous to health, noise at work and hand arm vibration;
- Manual handling risk assessments and safe handling techniques for manual handling activities;
- Health surveillance, sickness absence management, return to work policy and stress management strategy;
- Arrangements for managing subcontractors, including procedures for managing their occupational health risks; and
- Employers understanding their duties under the Construction (Design and Management) Regulations 2007 (CDM 2007).

- System concepts can help the employer to improve on his organisation's H&S planning, policies, and procedures and to minimise risks in construction industry (CDM 2007).

3.8 Hierarchy of risk control

According to HSE (2011) OHS hierarchy of controls identifies controls to be implemented prior to operation and or commencement of any undertaking.

- Design or reorganise to eliminate the hazard from the workplace;
- Remove or substitute the hazard;

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- Enclose or isolate the hazard;
- Minimize through engineering controls;
- Minimize the risk by adopting administrative controls;
- Personal Protective Equipment; and
- A combination of two or more controls need be used to minimize the risk to the lowest level that is reasonably practicable, if there is no single control appropriate (HSE, 2011; ABCS, n. d.).

3.9 Benefits of managing occupational health

The benefits of having a robust system for controlling and managing occupational health risks in construction organisations include;

- Reduced absenteeism;
- Reduced staff turnover;
- Retention of key staff;
- Lower healthcare costs;
- Reduced insurance premiums and compensation claims;
- Fewer work related ill health cases; and
- Improved productivity and staff morale (CDM 2007).

4.0 METHODOLOGY

The study is mainly a literature review survey on OHS risk management. The study is conducted with reference to existing theoretical literature, published and unpublished research.

5.0 FINDINGS

Findings from the study have shown that the construction industry has a high incidence of occupational ill health which can have a devastating effect on individuals. Efforts have focused more on safety hazards rather than on workplace hazards resulting in ill health issues. Managing occupational health goes beyond undertaking pre- start health checks, providing first aid and site welfare facilities. It involves organisations and employers having effective system of managing occupational health risks as well as compliance with health and safety legislation. Occupational health issues are not always immediately visible but can have the same devastating impact as accidents and injuries, sometimes causing prolonged and long term health problems. The appropriate preventive measures of risk assessment are not likely to be identified or put in place if H&S management approach is not carried out well or not done at all. Therefore, the employer must provide and maintain for employees a working environment that is safe and without risks to health as reasonably practicable. He must also ensure that employees are not exposed to risks to their health or safety arising from the conduct of the undertaking. Risk assessments are very important because they form an integral part of a good OHS

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management plan. Ranking or prioritizing hazards is one way to help determine which hazard is the most serious and thus which hazard to control first. Assessments should be done by a competent team of individuals who have a good working knowledge of the workplace. Five approaches to risk assessment have been found to identify hazards and those at risk, valuate and prioritise risks, decide on preventive action, take action, and monitor and review. Methods of hazard control have also been identified as engineering and administrative controls, and the use of PPE.

6.0 CONCLUSION

It can be concluded from the findings that the appropriate preventive measures of risk assessment is not likely to be identified or put in place if H&S management approach is not carried out well or not done at all. Therefore, there is the need for stringent measures to be put in place to handle OHS devastating impact. The approaches to risk assessment and methods of hazard control will lead to safe work environment and minimize the health impact on employees.

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ASSESSING THE IMPACT OF CHINESE FIRMS' LOW COST STRATEGY ON EMPLOYMENT OF LOCALS IN ZAMBIA

Kumbukilani Phiri[1], Surender Munjal[2] and Erastus Mwanaumo[3]

Abstract

Over the past few decades, China-Africa relationships have seen a very big shift from bilateral cooperation to private investments by Chinese companies in Africa. Chinese investments have also increased in all sectors of the economy spanning mining, agriculture, construction and infrastructure development (Gu, 2009). In Zambia, Chinese companies now command between 70-75% of contracts awarded by the Zambian government (Sautman and Yan, 2009). In 2011, China had more than 500 companies registered in Zambia with an investment volume of over US$2.6 billion creating about 50,000 employment opportunities for the locals. The main objective of this research is to understand the impacts of low cost strategy and culture on the operations of Chinese construction companies in Zambia in terms of employment of locals. For the purpose of this research, triangulation with emphasis on qualitative techniques was utilized. To achieve this unstructured and semi structured interviews were conducted with Chinese companies, Zambian companies and representatives from the Zambian government. There were two Chinese companies that participated in the interviews. To ensure for credibility of the data collection method, the researcher chose to interview respondents that were senior personnel with over four years of experience in their respective organisations and Africa. In conducting the data analysis, the interview transcripts were read several times, and questionnaires were reviewed using excel sheets. Only selected relevant information from the interviews and questionnaires was analysed as analysing all the information would prove to be much detail for the purpose of this investigation. The findings have shown that low cost strategy has an impact on Chinese construction company operations in Africa. In order for the Chinese companies to stay competitive and maintain low cost leadership, they have had to save cost in many ways which have a direct impact on their employment decisions which favour Chinese employees. The study provided insights on the subject and would ensure that foreign companies can employ more locals and government could seek ways to adequately provide skills training in the country so that foreign companies can find the skills that they need when they invest.

Key words: Low cost strategy, Chinese infrastructure investors, Chinese –Zambia relationship.

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1.0 BACKGROUND

Over the past few decades, China-Africa relationships have seen a very big shift from bilateral cooperation to private investments by Chinese companies in Africa (Gu, 2009). China has become the largest trade partner to Africa surpassing the United States of America (Paula, 2012). Chinese investments have also increased in all sectors of the economy spanning mining, agriculture, construction and infrastructure development (Haglund, 2008).

This study will concentrate on the operations of Chinese construction firms as regards their low cost strategy and Chinese culture; this due to the fact that in the past few decades Chinese construction firms have been increasing their market share in the African construction sector at a very fast rate. For instance, in 2002, Chinese construction firms had an estimated market share of 9.90% in the continent; however, by 2011 this percentage had increased to 40.10% (Peng, no date).During the same period European firms experienced a decline in their market share from 44.30% to 34. 60%, similarly the American firms suffered the worst decline from 24.10% in 2002 to 6.70% in 2011. Therefore, it is very clear that Chinese construction firms are now replacing both European and American construction firms in the continent and hence the importance to understand the impacts that this has on the continent.

Li (2010) argued that analysing China's engagement in Zambia is an ideal case for understanding Sino-African relations better; this is owing to the two countries historical relationship and the increasingly strengthening economic ties between the two countries. Zambia established diplomatic relations with China right after attaining its independence from the British colonial government (Muneku, 2009).

As a natural resources rich country, Zambia has also been one of the largest recipients of Chinese FDI. Muneku (2009) argued that while flows of Chinese FDI to Zambia are still modest compared to countries like Sudan, Nigeria and South Africa, they are still very significant given the size of the national economy. The Africa Development Bank report by Renard (2011) reported that the period covering 2003-07 saw more than half of Chinese FDI flows into three major resource rich countries of Nigeria (20.2%), South Africa (19.8%) and Sudan (12.3%). Zambia came on 5th position with 8% after Algeria which received 12%.

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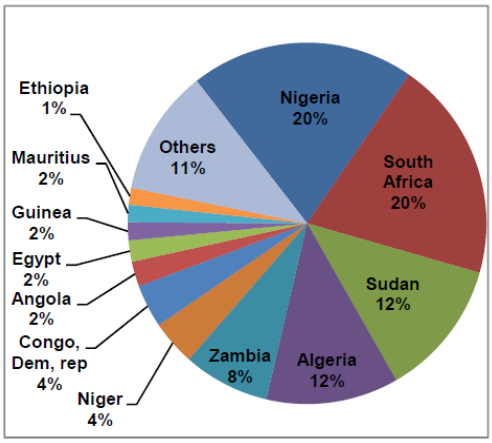

Figure1: China's FDI flows into Africa by destination (2003-2007)

Source: Africa Development Bank, (2011); China Ministry of Commerce, (2008)

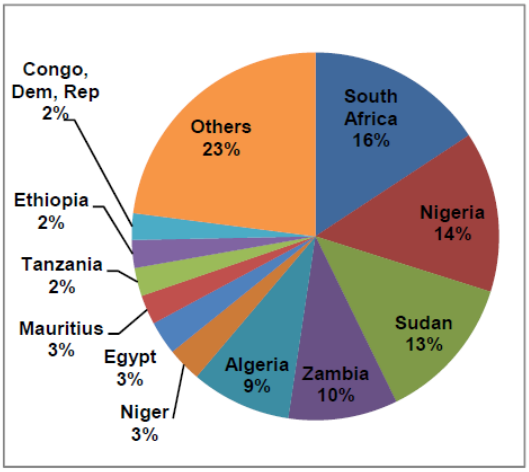

Figure 2: China's FDI stocks in Africa by location (2007)

Source: Africa Development Bank, (2011); China Ministry of Commerce, (2008)

According to the Zambia Development Agency (2014), Chinese companies have shown more interest to invest in Zambia than any other country so far. In the construction industry, Chinese companies now command between 70-75% of contracts awarded by the Zambian government (Sautman and Yan, 2009). In 2011, China had more than 500 companies registered in Zambia with an investment volume of over US$2.6 billion creating about 50,000 employment opportunities for the locals (Namutowe, 2013). This makes the study of the Chinese construction companies operations in Zambia an ideal case for this research.

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The main objective of this research is to understand the impacts of low cost strategy on the operations of Chinese construction companies in Zambia in terms of employment of locals.

2.0 METHODOLOGY

For the purpose of this research, triangulation with emphasis on qualitative techniques was utilized. This is in the form of data collection or data triangulation (Denzin, 1988). Saunders et al (2009) observed that the advantage of using multiple methods is that different methods can be used for different purposes in a study; interviews may be used at exploratory level while questionnaires can be used to collect descriptive or exploratory data. This approach gave confidence to address the most important issues of this research. To achieve this unstructured and semi structured interviews were conducted with Chinese companies, Zambian companies and representatives from the Zambian government. On the other hand one set of questionnaires was used to get descriptive data from the Chinese construction companies on the perception of their investment in Zambia and another set of questionnaires was used to understand the perception of Chinese investment by the Zambian public.

There were two Chinese companies that participated in the interviews. To ensure for credibility of the data collection method, the researcher chose to interview respondents that were senior personnel with over four years of experience in their respective organisations and Africa. As Hussey and Hussey (1997) pointed out, reliability is concerned with the findings of the research and is one aspect of the credibility of the findings. Validity is the extent to which research findings accurately represent what is really happening in the situation. According to Coolican (1992.p. 35) an effect or test is valid if it demonstrates or measures what the researcher thinks or claims it does. The lead researcher has very good Chinese proficiency and many years of experience working in China which helped in clarifying the interview questions to obtain accurate information from Chinese respondents whose English was not very good. The researcher also translated the questionnaire in Chinese in order to make it easier for the Chinese respondents to understand what was being asked.

In conducting the data analysis, the interview transcripts were read several times, and questionnaires were reviewed using excel sheets. Only selected relevant information from the interviews and questionnaires was analysed as analysing all the information would prove to be much detail for the purpose of this investigation. The review was centred on key responses pertaining to the three main research questions bordering on the main objective of assessing the impact of low cost strategy and culture on employment of locals.

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3.0 FINDINGS

3.1 Questionnaire Results on Employment of local labour

Chinese companies questionnaire results

Survey results obtained reveal that 33% of Chinese construction companies agreed that local labour is reliable while 34% were neutral with 22% disagreeing and 17% strongly disagreeing. 56% of Chinese companies indicated that they invested in Zambia to take advantage of the local unskilled and low skilled labour, surprisingly 22% of Chinese companies disagreed that they invested in Zambia to take advantage of semi to high skilled labour while 17% strongly disagreed and 39% were neutral. 33% of Chinese companies also agreed that they can find most of the required skills from the local labour force with 33% being neutral and 28% disagreeing while 6% strongly disagreed. 78% of Chinese companies claimed to provide training to locals while 61% also claimed to promote hardworking locals to take over from foreign managers. 44% of Chinese companies agreed that local managers can perform at level with foreign managers and 50% of Chinese companies indicated that they plan to replace all foreign managers with locals. Figure 3 provides a summary of responses from the 18 Chinese construction companies that took part in the survey.

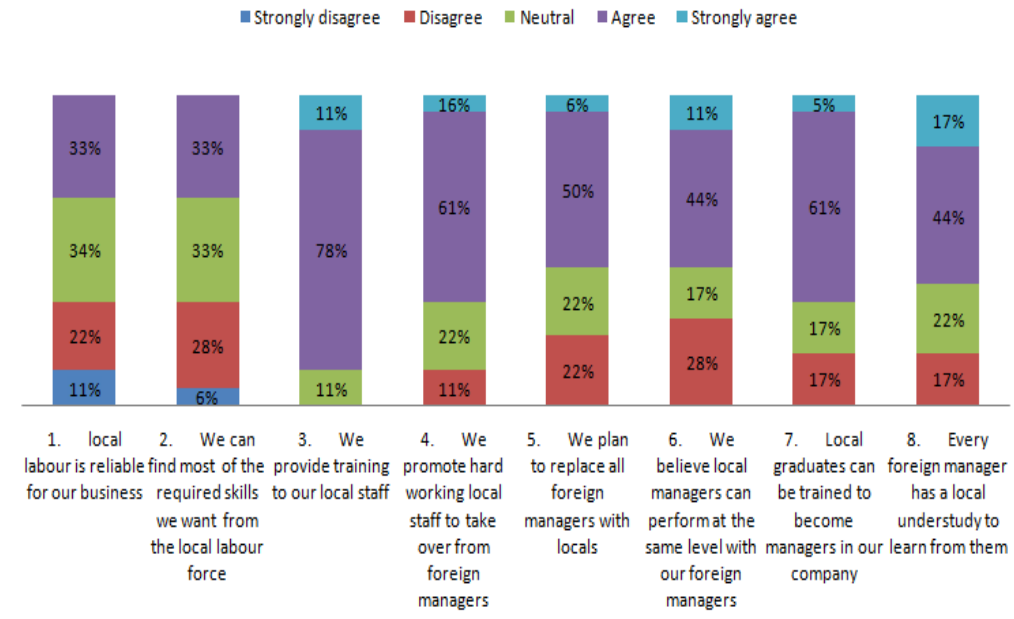

Figure 3: Use of local labour: An empirical survey from Chinese construction companies

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Zambian public questionnaire results

31% of the people agreed that Chinese investors in the construction industry find Zambian labour reliable for their business while 12.38% strongly agreed. In terms of Chinese investors easily finding most of their required skills they need for their operation, the research findings show that 33% agreed that Chinese investors can find most of their required skills within Zambia and 20% strongly agreed. Survey results have also shown that 32% of Zambian respondents disagreed that Chinese construction companies provide training to the local employees while 24% strongly disagreed while 28% were neutral. 44% of Zambian respondents disagreed that Chinese construction companies promote hard working Zambian workers while 36 strongly disagreed with 15% being neutral. 32% of the respondents agreed that local managers can perform at the same level with foreign managers, while 38% strongly agreed with only 8% being neutral. 24% of respondents also agreed that local graduates can be trained to become managers in foreign firms, while 58% strongly agreed. 22% of the respondents disagreed that Chinese managers do have a local employee to understudy them, with 12% strongly disagreeing while 41% were neutral. Figure 4 provides a summary of responses from the 144 Zambians that took part in the survey.

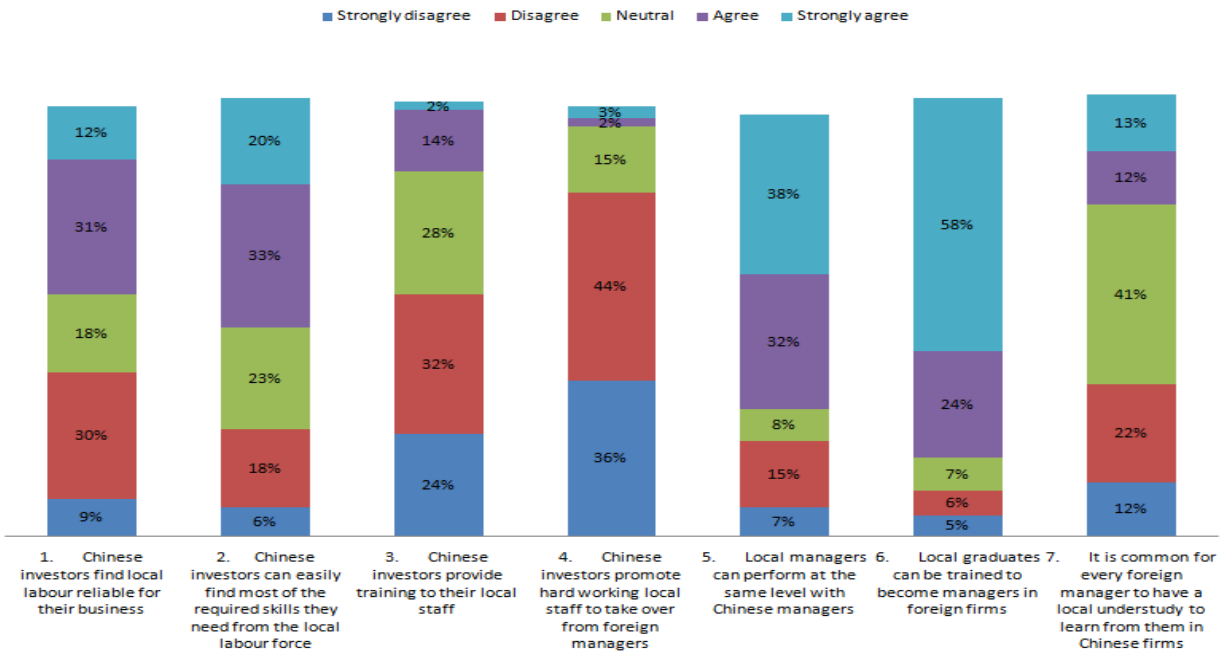

Figure 4: Use of local labour: An empirical survey from the Zambian public

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3.2 Interview Results on Employment of Locals

In total six interviews were conducted, two of them were face to face interviews which were conducted in Zambia with government officials from the Zambia Development Agency and the Road Development Agency of Zambia. The remaining interviews with two representatives from the Chinese companies and two representatives from the Zambian companies were conducted over the phone. All the interviewees chose not to be recorded, therefore, for ethical reasons the author did not record any interviews. For confidentiality reasons officials from ZDA and RDA will only be referred to as ZDA official and RDA official. Chinese representatives will be referred to as C1 and C2, while Zambian representatives will be referred to as Z1 and Z2.

Chinese companies results - Impacts of low cost strategy employment of locals

The results of the two Chinese construction companies came from the semi-structured and unstructured questions. The purpose of the Chinese construction company interviews was to establish how Chinese construction companies perceived their operations in the country and whether they felt that their business strategy (low cost) and culture had an impact on their operations in Zambia in terms of employment of locals, use of local suppliers and their participation in corporate social responsibility. In short, did their low cost strategy and culture affect their decisions on who they employed and used as their supplier, and how they participated in corporate social responsibility?

C1 felt that Chinese companies do not deliberately compete on price as they also want to make profits from their projects. However, they have more cost advantages than other companies from other countries since most of the machinery, equipment and materials that are used in construction are mostly procured from China. China also has a very large source of cheap skilled labour; therefore Chinese companies have lower fixed and operation costs.

C2 pointed out that it was hard for him to single out one particular strategy that his company was using because generally it depended on the projects they are bidding for. For instance, for long term big project, his company goes for lower profit margins, however, for small projects, they try as much as possible to be competitive and do not compete on low profit margins. During their initial stages they used low pricing in order to build their reputation and capacity.

On the influence that low cost strategy has on employment of locals, C1 mentioned that the hiring of Chinese employees was actually expensive. Chinese companies have to think about helping Chinese employees with passports and visas, pay for their flights, pay for their accommodation, pay them a good salary in order to be willing to leave their families to come

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and work in Africa. However, to ensure that projects are completed within budgets, with the desired quality and on time, experienced Chinese workers are the best option.

C2 felt that the reason why Chinese companies hire more Chinese skilled workers is because there are very few qualified Zambians who can do the job properly, so for them to stay competitive and deliver projects as per contract, they depend on Chinese labour. He also felt that it was not cheaper to hire a Chinese given that the company had to spend a lot of money to bring them abroad and pay them a salary which is more than 5 times what they get in China. However, their experience justifies the expenses incurred on them.

Table 1: Summary of responses on impacts of low cost strategy

	Chinese construction companies use low cost strategy?	**Impacts of low cost strategy on employment of locals**
C1	Agreed	Positive effect; Chinese workers though expensive are more experienced to guarantee that projects are finished on quality, time and cost
C2	Agreed	Positive effect; Chinese workers though expensive are more experienced and reliable to guarantee projects are completed on profit;

Zambian companies results - Impacts of low cost strategy on the employment of locals

Below is the summary of the interview with Z1 and Z2 from Zambian construction companies about Chinese operations in Zambia.

Z1 believes that Chinese companies are low cost bidders in most tenders in Zambia.

On the effect of this strategy on employment of locals, Z1 pointed out that Chinese companies' offer Zambian engineer's very low salaries leading to very few Zambians accepting to work for them. Most of his friends from the university are working either for the government or other foreign companies. He believes that if the Chinese companies are paying Chinese engineers and technicians the same low salaries then he can understand why they could quote low prices for projects.

Z2 pointed out that before 2000, there were very few Chinese construction companies on the continent, and most of them were doing Chinese funded projects. However, the last decade has seen an influx of Chinese construction companies who have resorted to competing on low cost to win market share. These companies are able to beat the market because of their low cost labour, machinery and equipment from China as well as financial support from their government.

Z2 believes that low cost strategy as an operational model entails using different measures to cut cost. Chinese companies have preferred bringing in Chinese workers in order to cut cost on

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training of locals. This is unlike South African and European companies that were operating in Africa before who depended on local labour and only had part of top management from abroad. He mentioned that most of skilled labourers in Zambia will boast of having learned the skills from South African or Western construction companies. The situation has been made worse because Chinese companies barely pay a minimum wage, so the risk of Zambian employees leaving for better paying jobs after receiving the training is very high.

4.0 DISCUSSION

In the literature review it was argued that just like in any industry, a construction company also needs to follow a distinct strategy of either cost leadership or differentiation in order to compete (Porters, 1980, 85; Kale and Arditi, 2002). In line with various studies that have been conducted in the past, this research has also established that Chinese construction companies do employ a low cost strategy to win business in Africa. This was confirmed in interviews with C1, C2, Z1, Z2 and RDA official who all talked of Chinese companies winning business through using low cost strategy. As an objective of this research, it was established that low cost strategy led to Chinese companies preferring experienced Chinese workers to Zambian workers who might need training that would increase their cost of operation. This is despite the fact that both Chinese and Zambian respondents in the questionnaires felt that Chinese companies can find all the required skills within the Zambian labour force and that Zambian workers are reliable. Perhaps the reason could be as Z2 put it that since Chinese companies barely pay a minimum wage, the risk of losing Zambian workers to better paying competitors after training them is very high hence this could increase their cost of training given that they will keep training workers and losing them. On the other hand, 56% of Chinese construction companies agreed that they invest in Zambia to take advantage of the unskilled and low skilled labour, however, only 17% of these companies agreed to investing in Zambia to take advantage of the semi to high skilled labour. This controversy was made clear by the interview with both C1 and C2 who pointed out that unlike the public belief that Chinese companies bring in Chinese workers because it is cheaper; the truth was actually the opposite. According to them it is actually expensive for Chinese companies to bring in Chinese workers due to the costs they have to incur, however they are willing to do this as they can save in terms of training costs and Chinese workers can help guarantee that their projects will be completed on quality and time. So in short preference for Chinese workers is not because Zambia lacks skilled labourers as Brautigam (2009) mentioned, however, it is a cost saving measure which can be attributed to training costs.

The main objective of this research was to see whether low cost strategy and culture have an impact on Chinese construction companies operations in Africa in terms of employment of locals, use of local suppliers and participation of Chinese construction companies in corporate social responsibilities.

Literature review and this research have both shown that low cost strategy has an impact on Chinese construction company operations in Africa. In order for the Chinese companies to stay

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competitive and maintain low cost leadership, they have had to save cost in many ways which have a direct impact on their employment decisions which favour Chinese employees.

Further, low cost strategy has also disadvantaged local suppliers as they cannot compete to supply foreign sourced products. In the same line Chinese construction firms have tried to reduce transaction costs by procuring products by themselves or using foreign suppliers as Zambian suppliers are mostly viewed as being unreliable. It was also established that Chinese construction companies do benefit from the ZDA Act No.11 of 2006 which allows investors registered under it to bring in capital equipment and machinery duty free. This disadvantages local suppliers who need to pay duty for imported products.

As part of the objective, Culture was also found to play a big role in the operations of Chinese companies. It has been established that culture and language do have an impact on employment decisions in Chinese construction companies where locals are only employed as labourers or helpers with almost all semi-high skilled workers coming from China.

It has also been established that culture impacts on the choice of suppliers and contractors by Chinese construction companies. Chinese people prefer doing business with people from within their ‘guanxi’ or networks which locals are not part of.

This research has also established that Chinese culture plays a part in the way Chinese construction companies view corporate social responsibility as they view it as a Western idea. However, lack of participation of Chinese companies in corporate social responsibility had no direct link to their low cost strategy.

5.0 CONCLUSION AND RECOMMENDATION

Based on this research, the following are some of the recommendations. In order to ensure that foreign companies can employ more locals, the government needs to ensure that there are adequate skills training in the country so that foreign companies can find the skills that they need when they invest. More trades schools need to be established where Zambians can be trained in construction skills. There is also need for effective monitoring mechanism to restrict the number of foreigners who can come into the country so that construction companies can source their workers locally and help in capacity building. Entry visas should be restricted for skills that are not in adequacy in the country. In addition the government should also be strict on the number of years that foreigners can stay in the country so that they can leave room for Zambians to take over from them. There should also be strict measures to only allow foreigners attaining a certain level of English proficiency to come in the country; this will remove language barriers and enable foreign companies to source for workers locally.

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On the other hand, Zambian workers should also consider learning mandarin in order to become more employable in Chinese firms. Chinese companies should be encouraged to hold English lessons for their Chinese staff as well as Mandarin lessons for their local staff. There should also be more cultural sensitisation in both Chinese and Zambian communities. The Chinese should try their best to integrate more in the Zambian communities and learn the Zambian culture. Without completely neglecting security measures, Chinese construction companies should encourage their workers to live among Zambian communities other than in Chinese communities or camps. This will reduce the distance between the two cultures and integration will be more effective.

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