Association of Schools of Construction of Southern Africa

The Tenth Built Environment Conference
31 July - 2 August 2016, Port Elizabeth, South Africa

Conference Proceedings
The ASOCSA Built Environment conference series has become the undisputed leading built environment conference on the African continent. It is one of only two construction-related conferences in South Africa that has been fully accredited by the Department of Higher Education (DHET) for subsidy. Since its inception in 2006 the blind peer reviewed conference proceedings have been referred to by private and public sector policy and decision makers. The series produces a post-conference edition of the Journal of Construction, which is on the list of journals approved by the South African Department of Higher Education and Training (DHET) for subsidy. The series continues to be underwritten by major industry stakeholders that have included the Construction Industry Development Board (CIDB), Council for the Built Environment (CBE), Master Builders South Africa (MBSA), branches of the MBA, major construction companies and PPC Cement. It has been endorsed by the International Council for Research and Innovation in Building and Construction (CIB), one of the largest global built environment research organizations.

OBJECTIVES

The Tenth Built Environment Conference continued in the tradition of previous conferences in the series and provided in an ever-increasing challenging global economic environment with shrinking sponsorship budgets an international forum with a very clear industry development and sustainability focus that provides the opportunity for researchers and practitioners from developed, developing and underdeveloped nations to deliberate topical current issues that impact the Built Environment.

The broad objectives of the conference are:

- To provide a forum for multi-disciplinary interaction between academics and industry practitioners;
- To disseminate innovative and cutting edge practices that respond to the conference theme and outcomes, namely Reflections on Directions in Construction;
- To provide a world class leading internationally recognized, accredited conference for the built environment; and
- To contribute to the existing built environment body of knowledge (BEBOK) and practice.

The conference organizers brought together in a single forum a group of researchers and academics from the full range of built environment disciplines that include engineers, architects, quantity surveyors, construction and project managers. Delegates were drawn not only from South African institutions of higher education, government agencies, and other construction-related organizations but also from the African continent, Australia, Europe and the United Kingdom.

CONFERENCE THEME AND OUTCOMES

The Built Environment: Towards a Renaissance

This conference sought responses to questions related to current conversations and debates on infrastructure delivery and sustainability such as, for example,

- Infrastructure Development Management
- Integrated Project Delivery (IPD) including professional practice
- Sustainable Green Building
- Information and Communication Technologies (ICT) including
- Innovative construction education
- Building Information Modelling
- Improved project management
- Inappropriate construction practices and ethics
- Construction Health and Safety
- Construction contracts
- Innovation in construction technologies

and includes papers that address, inter alia,

- Current trends and developments
- Policies
- Legislation and regulations
- Practices
- Case studies

These internationally peer reviewed and edited proceedings were aimed at contributing significantly to the body of knowledge relative to the science and practice of construction not only in South Africa but everywhere that the products of construction are being produced.

Ferdinand Fester
Port Elizabeth, South Africa
August 2, 2016
ACKNOWLEDGEMENTS

The organizing committee of The Tenth Built Environment conference, held in Port Elizabeth, South Africa, wish to thank the Council of the Association of Schools of Construction of Southern Africa and membership universities and individuals for supporting this conference through their valued contributions. Without that support this conference and the further development and growth of the Association of Schools of Construction of Southern Africa (ASOCSA) with respect to its mission in the region would not have been possible. Further, this support demonstrates the commitment to the further development of the body of knowledge relative to the science and practice of construction. This commitment is deeply valued and acknowledged.

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

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

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

ORGANISERS – SOUTH AFRICA

Ferdinand Fester, University of Johannesburg, South Africa, President
Prof Theodore Haupt, Academic Chair
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PEER REVIEW PROCESS

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

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

Broad Aims

ASOCSA aims to be the professional association for the development and advancement of construction education in Southern Africa, where the sharing of ideas and knowledge inspires, guides and promotes excellence in curriculums, teaching, research and service. To achieve this aim ASOCSA is partnering with the construction industry to find ways to effectively represent the interests of both construction academic and industry practitioners. ASOCSA will offer a variety of programs and services designed to help its members serve their customers more effectively and succeed in an increasingly challenging environment of construction information management and technology. To this end ASOCSA provides a forum for the debate and discussion of issues of mutual interest to all industry stakeholders. For example, one of the tasks of ASOCSA will be supporting the development of curriculums that address the needs of the construction sector in the Southern African region. ASOCSA convenes an annual conference that is one of only two construction-related conferences accredited by the Department of Higher Education and Training (DHET) where construction academics and practitioners can interact relative to practical experience and the findings of relevant research. This conference series is endorsed and underwritten by the International Council for Research and Innovation in Building and Construction (CIB) as well as several major industry stakeholders.

The Journal of Construction which is accredited by the Department of Higher Education presently published electronically four times per year is the official journal of ASOCSA and in the past more than 5,000 complimentary copies were distributed to all industry stakeholders in the Southern African region. The production and distribution of practice notes and technical papers is a further endeavor to grow the partnership between academia and industry.

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

Vision

To drive innovative construction related higher education

Mission Statement

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

Strategic objectives

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

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

Heads Forum meetings

ASOCSA believes that meetings of the Heads Forum comprising of Heads of School and Departments of Construction is a vital component of its functions and holds Heads meetings during each conference. It is still the aim of ASOCSA to bi-annual Heads meetings.

International Affiliation

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

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

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University of Kwa-Zulu Natal

For more information on ASOCSA and its activities visit www.asocsa.org
27 July 2016

Dear Author

PEER REVIEW PROCESS: 10TH BUILT ENVIRONMENT CONFERENCE: PORT ELIZABETH, SOUTH AFRICA 2016

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

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Regards

Ferdinand Fester (ASOCSA President)
Prof Theo C Haupt (ASOCSA Vice-President)

Ms Ferial Lombardo (ASOCSA Conference Organizer)
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Adapt or Die! Building Information Modelling (BIM)

Theo C. Haupt¹ and Elke Hefer²
Haupt@ukzn.ac.za¹ and elkeh@dut.ac.za²

¹ Construction Studies Program, School of Engineering, University of KwaZulu-Natal, Durban 4000, South Africa.
(Tel: +27 31 2062712)

² Department of Construction Management and Quantity Surveying, Durban University of Technology, Durban 4026, South Africa.
(Tel: +27 31 3732010)

ABSTRACT AND KEYWORDS

Purpose: The emergence of Building Information Modelling (BIM) demands that quantity surveyors review their roles in the construction sector. This study examines the responsiveness of the quantity surveying discipline to BIM.

Design/methodology/approach: A sample of quantity surveyors in Durban will be surveyed using an instrument developed from published literature on responses of quantity surveying to BIM.

Research limitations: The sample of quantity surveyors was drawn from the Durban area using the Association of South African Quantity Surveyors (ASAQS) and South African Council for the Quantity Surveying Professions (SACQSP) database.

Findings: Preliminary findings suggest that quantity surveyors’ knowledge about BIM, software and innovation was at best rather average. They recognized the most obvious benefits of embracing BIM such as the time taken to produce Bills of Quantities and accurate cost estimation. Largely because of their lack of knowledge of available technologies they could not comment assertively on many of the issues surrounding the relationship between BIM and quantity surveying. This further resonates with the uncertainty that exists surrounding BIM and its business value and return on investment. They disagreed that technological advancements presented threats to their existence or the services that they traditionally offered. In the main the findings of the study resonated with those of other studies done particular in developing countries.
Response to conference theme: This study identifies the reasons why BIM is not being readily embraced by quantity surveyors more pervasively.

Practical implications: The findings provide the opportunity to improve the services currently offered by quantity surveyors but also new and innovative services driven by BIM

Keywords: Quantity surveying, BIM, computer hardware, computer software

Conference sub-theme: Construction Education

1. INTRODUCTION

BIM technologies, processes and policies are significantly impacting industry’s deliverables, relationships and roles (Succar and Kassem, 2016). BIM, as a process, allows the exchange of information among the project stakeholders, such as architects, engineers, contractors, consultants and clients (Teo, et al, 2016), and by inference quantity surveyors. While the technology underpinning BIM has been around its implementation and take-up has been particularly slow in the construction sector. BIM provides opportunities and challenges for the quantity surveying discipline. As a consequence the role of the quantity surveyor of necessity must also adapt to provide more sophisticated services as part of the evolving integrated project delivery approach. This study examines the perceived impact of BIM on the quantity surveying discipline as currently practised in KwaZulu-Natal to determine the level of knowledge of BIM and the readiness of the discipline to embrace BIM.

2. DEFINING BIM

According to Building Smart (2012:7) BIM is defined as:

… a 3D object database that can be easily visualized, has rich data and structured information. Building Information Modeling is a process of representing building and infrastructure over its whole life cycle from planning, design, construction, operations, maintenance and recycling. BIM importantly provides a framework for collaboration, a multi-disciplinary environment that brings together all the parties that design, construct and operate a facility, suggesting a new model of procurement, Integrated Project Delivery (IPD).

According to RICS (2012) BIM requires a different way of thinking and a new approach to project procurement and delivery with BIM becoming the primary tool for the entire project team.
3. THREATS TO THE ROLES OF QUANTITY SURVEYORS

Every profession must evolve in response to the ever-increasing changes in the global economy and quantity surveying practices are not absolved from this challenge (Frei, Mbachu and Phipps, 2013; Oyewobi, Ibironke and Oladosu, 2015). The traditional role of quantity surveyors may be viewed as providing the financial and commercial management services on construction projects – also known as a building economist (Cunningham, 2014). These traditional roles include:

- Preparing approximate estimates of costs;
- Cost planning and value analysis;
- Advising on procurement options;
- Preparation of bills of quantities and other contract documents;
- Adjudication of tenders;
- Negotiation of rates;
- Valuing work in progress;
- Preparing final accounts;
- Advising on contractor claims;
- Advising on costs and preparing cost reports;
- Giving specialist advice such as, for example, technical auditing, valuations for insurance, advising on taxation and capital allowances, risk analysis and management, project management, health and safety and quality (Hore, O’Kelly and Scully, 2009).

According to Frei and Mbachu (2009) the quantity surveying discipline needs urgent and far-reaching transformation if it is to survive and remain relevant. Ofori and Foor (2009) opined that many observers have predicted and many within the discipline itself fear that quantity surveying might disappear as a formal profession. Frei, Mbachu and Phipps (2013) identified a list of threats to quantity surveying, namely market/competition, capability/capacity, recognition/relevance and information/communication/technology. Threats included the following:

- Continued departure from traditional procurement methods and associated fall in demand for quantity surveying services;
- Relative obscurity of the quantity surveying discipline;
- Blurring of professional boundaries allowing erosion of existing market share by other professionals;
- Shortages of suitably skilled professional and quality graduates threatening long term success of discipline;
- Advances in information technology such as computer-aided drafting (CAD) and BIM threatening the role of quantity surveyors;
- Building market fluctuations; and
- Demise of published scales of fees and resultant levels of fee competition affecting quality of services offered.
4. ADOPTION OF BIM

A study by RICS (2011) found that 61% of the quantity surveying firms that they had surveyed had no engagement with BIM. For those using BIM the most frequent use was for construction scheduling (14%) followed by extraction of quantities and facilities/asset management (8% each). Only 4% of quantity surveying practices regularly invested in BIM training and only 10% actively assessed BIM tools for potential adoption. These findings suggest that QSs are not embracing BIM as pervasively as they could. The barriers cited were lack of client demand, training, application interfaces and standards. In their study Ashworth, Hogg and Higgs (2013) found that the five most dominant problems of using computers in quantity surveying were maintaining programs, integration of processes, cost containment, recruitment, and meeting project deadlines.

The move towards BIM capability and expertise requires quantity surveying practices to re-evaluate and re-engineer their business practices (RICS, 2011). BIM enables collaboration between users through better visual understanding of the building artifact (Matipa, Cunningham and Naik, 2010). BIM is able to generate and analyse different views, data and information appropriate to various users’ needs, which can be used to facilitate decision making and to improve the process of delivering the facility (AGC, 2010 cited in Teo et al, 2016). The important feature of BIM is its capability to enable the item to be constructed to be built virtually, prior to building it physically, in order to identify and resolve problems, and simulate and analyze potential impacts (Smith, 2007 cited in Teo et al, 2016). BIM can be used for many other purposes in the design and construction process such as visualization, scope clarification, trade coordination, collision detection and avoidance, design validation, construction sequencing planning, plans and logistics, marketing presentations, options analysis, walk-throughs and fly-throughs, virtual mock-ups and sight-line studies (AGC, 2010 cited in Teo et al, 2016).

According to Gerrard et al. (2010) the lack of BIM expertise, lack of awareness and resistance to change were the main barriers to BIM adoption (cited in Zhao, Gao and Pienaar, 2016). Where they have been used they have been at the basic stages only with no advancement into the usage of sophisticated software because of the negative perceptions and fraudulent activities. The construction industry, and by inference quantity surveying, has been found repeatedly to be reluctant to apply new technologies and employs lower levels of BIM than other industries (Yang, 2007). Further, organizations tended to resist giving up and changing established ways of doing things and familiar BIM products (Lawrence and Scanlan, 2007). This tendency is referred to as organizational inertia. The scarcity of BIM conversant practitioners and the lack of highly skilled cross trained staff with both construction and IT skill are some of the major barriers hindering the widespread adoption and realisation of BIM benefits (Hartmann & Fischer, 2008; Fox and Hietanen, 2007; cited in Nuramo and Haupt, 2016).
It is argued that lack of skilled and knowledgeable professionals is one of the bottlenecks for successful implementation of the technology in developing countries (Nuramo and Haupt, 2016). It is further argued that unclear business value and return on investment (ROI) are often identified as barriers for adoption (Barlish & Sullivan, 2012 cited in Sanchez, Mohamed and Hampson, 2016). Firms implementing BIM have also stated that a major challenge towards their adoption of BIM has been that they themselves have not had sufficient time to evaluate the business value of BIM and experience a lack of knowledge about the business value of BIM ((McGraw-Hill 2009, 2010) FMI and CMAA 2007, cited in Vass, 2016). It is therefore important that quantity surveyors appreciate BIM, understand their potential and develop and employ effective processes and tools to integrate technologies into their current practices (Cartlidge, 2011).

5. RESEARCH APPROACH

A convenience sample of 45 quantity surveyors either employed or practicing for themselves in the Durban area of the KwaZulu-Natal province of South Africa were surveyed about their views of the impact of BIM on quantity surveying. The data was collected via a quantitative questionnaire survey comprising of several sections such as knowledge and experience of BIM, benefits, barriers and readiness. Almost all questions took the form of statements around the various themes which required a scaled response of agreement. Descriptive statistics were derived using SPSS v23 and presented including measures of central tendency and dispersion. The internal validity of scaled responses was determined by the Cronbach’s alpha co-efficient for validity.

6. RESEARCH FINDINGS

Profile of respondents

Most respondents had been in business for between 1 to 10 years (63.6%) and between 11 to 20 years (31.8%). Just more than half of the respondents (56.1%) considered their practices or firms ready for BIM and its introduction. They rated their knowledge and experience of BIM and its related applications as shown in Table 1 with 1=very low and 5=very high.

<table>
<thead>
<tr>
<th>Knowledge</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experience</td>
<td>19.0</td>
<td>38.1</td>
<td>28.6</td>
<td>14.3</td>
<td>-</td>
<td>2.38</td>
<td>0.96</td>
</tr>
</tbody>
</table>

Table 1. Knowledge and experience of BIM, software and innovation (n=42)
Respondents tended to have less than average knowledge (mean=2.98) and experience (mean=2.38) of BIM and its related applications. Respondents were neutral (mean=3.07) on the introduction and adoption of BIM in quantity surveying and the potential reshaping of quantity surveying roles and practices that it will introduce possibly because of their lack of knowledge and experience of BIM.

Reliability

Table 2 shows the Cronbach’s alpha co-efficient for the scaled responses of each of the four constructs. There is an acceptable degree of internal consistency for the scales used for all the constructs, namely a Cronbach Alpha statistic which is greater than the rule-of-thumb 0.70) for acceptable internal scale consistency. There is therefore between 72.4% and 87.4% probability that the constructs each measure a single underlying concept with an error of at most 5%. The scales used to measure the perceptions of BIM and its related applications in quantity surveying are therefore acceptable in their measure of the reliability of the constructs.

Table 2. Reliability statistics

<table>
<thead>
<tr>
<th>Construct</th>
<th>Cronbach’s alpha co-efficient (n=42)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIM and quantity surveying</td>
<td>0.724 (25 items)</td>
</tr>
<tr>
<td>Benefits of BIM</td>
<td>0.824 (8 items)</td>
</tr>
<tr>
<td>Barriers of BIM</td>
<td>0.874 (8 items)</td>
</tr>
<tr>
<td>Knowledge and experience</td>
<td>0.823 (2 items)</td>
</tr>
</tbody>
</table>

BIM and quantity surveying

Respondents were presented with 25 statements about BIM and its related applications and quantity surveying and were asked to indicate their level of agreement on a 5-point Likert scale where 1=strongly disagree, 2=disagree, 3=neutral, 4=agree and 5=strongly agree. The findings are shown in Table 3 ranked by the means of their responses.
<table>
<thead>
<tr>
<th>Factor/Influence</th>
<th>1 (%)</th>
<th>2 (%)</th>
<th>3 (%)</th>
<th>4 (%)</th>
<th>5 (%)</th>
<th>Mean</th>
<th>SD</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Software reduces the time to produce BoQs</td>
<td>2.4</td>
<td>4.8</td>
<td>2.4</td>
<td>50.0</td>
<td>40.5</td>
<td>4.21</td>
<td>0.90</td>
<td>1</td>
</tr>
<tr>
<td>BIM increases efficiency of quantity surveying</td>
<td>-</td>
<td>-</td>
<td>19.0</td>
<td>59.5</td>
<td>21.4</td>
<td>4.02</td>
<td>0.64</td>
<td>2</td>
</tr>
<tr>
<td>Cost estimation can be improved by BIM</td>
<td>2.4</td>
<td>9.5</td>
<td>-</td>
<td>64.3</td>
<td>23.8</td>
<td>3.98</td>
<td>0.92</td>
<td>3</td>
</tr>
<tr>
<td>BIM promotes collaboration between stakeholders</td>
<td>-</td>
<td>2.4</td>
<td>19.0</td>
<td>59.5</td>
<td>19.0</td>
<td>3.95</td>
<td>0.70</td>
<td>4</td>
</tr>
<tr>
<td>BIM requires new skills and knowledge</td>
<td>-</td>
<td>11.9</td>
<td>16.7</td>
<td>40.5</td>
<td>31.0</td>
<td>3.90</td>
<td>0.98</td>
<td>5</td>
</tr>
<tr>
<td>BIM allows the quantity surveyor to focus on strategic activities</td>
<td>-</td>
<td>4.8</td>
<td>28.6</td>
<td>52.4</td>
<td>14.3</td>
<td>3.76</td>
<td>0.76</td>
<td>6</td>
</tr>
<tr>
<td>BIM enhances life cycle costing data provision to clients</td>
<td>2.4</td>
<td>4.9</td>
<td>26.8</td>
<td>51.2</td>
<td>14.6</td>
<td>3.71</td>
<td>0.87</td>
<td>7</td>
</tr>
<tr>
<td>BIM automates taking off and BoQ production</td>
<td>4.9</td>
<td>7.3</td>
<td>24.4</td>
<td>52.1</td>
<td>12.2</td>
<td>3.59</td>
<td>0.97</td>
<td>8</td>
</tr>
<tr>
<td>BIM increases program certainty at the tender stage</td>
<td>-</td>
<td>9.5</td>
<td>38.1</td>
<td>38.1</td>
<td>14.3</td>
<td>3.57</td>
<td>0.86</td>
<td>9</td>
</tr>
<tr>
<td>Upfront costs are too high</td>
<td>2.4</td>
<td>11.9</td>
<td>28.6</td>
<td>45.2</td>
<td>11.9</td>
<td>3.53</td>
<td>0.94</td>
<td>10</td>
</tr>
<tr>
<td>BIM can streamline the procurement process</td>
<td>2.4</td>
<td>4.8</td>
<td>40.5</td>
<td>45.2</td>
<td>7.1</td>
<td>3.50</td>
<td>0.80</td>
<td>11</td>
</tr>
<tr>
<td>BIM potentially removes many mundane elements of traditional quantity surveying</td>
<td>7.1</td>
<td>11.9</td>
<td>23.8</td>
<td>42.9</td>
<td>14.3</td>
<td>3.45</td>
<td>1.11</td>
<td>12</td>
</tr>
<tr>
<td>There is a scarcity of available training on BIM</td>
<td>2.4</td>
<td>12.2</td>
<td>39.0</td>
<td>34.1</td>
<td>12.2</td>
<td>3.41</td>
<td>0.95</td>
<td>13</td>
</tr>
<tr>
<td>Financial and time commitment from small practices is too large</td>
<td>4.8</td>
<td>19.0</td>
<td>26.2</td>
<td>38.1</td>
<td>11.9</td>
<td>3.33</td>
<td>1.07</td>
<td>14</td>
</tr>
<tr>
<td>Organizational inertia prevents the adoption of new BIM</td>
<td>4.8</td>
<td>16.7</td>
<td>35.7</td>
<td>31.0</td>
<td>11.9</td>
<td>3.29</td>
<td>1.04</td>
<td>15</td>
</tr>
<tr>
<td>Additional costs of training make BIM prohibitive</td>
<td>4.8</td>
<td>19.0</td>
<td>35.7</td>
<td>28.6</td>
<td>11.9</td>
<td>3.24</td>
<td>1.05</td>
<td>16</td>
</tr>
<tr>
<td>BIM is too expensive</td>
<td>4.8</td>
<td>11.9</td>
<td>45.2</td>
<td>33.3</td>
<td>4.8</td>
<td>3.21</td>
<td>0.90</td>
<td>17</td>
</tr>
<tr>
<td>Roles and responsibilities of quantity surveyors will change</td>
<td>4.8</td>
<td>35.7</td>
<td>16.7</td>
<td>33.3</td>
<td>9.5</td>
<td>3.07</td>
<td>1.13</td>
<td>18</td>
</tr>
<tr>
<td>Quantity surveyors resist the introduction and adoption of BIM</td>
<td>9.5</td>
<td>23.8</td>
<td>26.2</td>
<td>31.0</td>
<td>9.5</td>
<td>3.07</td>
<td>1.16</td>
<td>19</td>
</tr>
<tr>
<td>There are problems with legal</td>
<td>-</td>
<td>28.6</td>
<td>47.6</td>
<td>23.8</td>
<td>-</td>
<td>2.95</td>
<td>0.73</td>
<td>20</td>
</tr>
</tbody>
</table>
Respondents tended to agree strongly that software would reduce the time to produce Bills of Quantity (mean=4.21). They tended to agree that BIM would increase the efficiency of quantity surveying (mean=4.02) but would require new skills and knowledge (mean=3.90). They also tended to agree that cost estimation could be improved (mean=3.98), BIM would allow the quantity surveyor to focus on strategic activities (mean=3.76) and promote collaboration between stakeholders (mean=3.95). The Respondents further tended to agree that BIM automates taking off and BoQ production (mean=3.59), can streamline the procurement process (mean=3.50) and potentially removes many mundane elements of traditional quantity surveying (mean=3.45). Respondents tended to disagree strongly that technological developments were for architects and designers only (mean=1.88). They tended to disagree that quantity surveying practices were too small to embrace BIM (mean=2.38). What was noticeable were the large proportions of respondents who had neutral views about several of the issues such as there being problems with legal ownership of information (47.6%), information and communication technologies being too expensive (45.2%) and there being no client demand for BIM (42.9%). These findings might be indicative of their lack of knowledge and experience with new technological advances.

Benefits of BIM

Respondents were presented with eight benefits of BIM to quantity surveying and were asked to indicate their level of agreement on a 5-point Likert scale where 1=strongly disagree, 2=disagree, 3=neutral, 4=agree and 5=strongly agree. Their responses ranked by the means are shown in Table 4.

<table>
<thead>
<tr>
<th>Benefit</th>
<th>1 (%)</th>
<th>2 (%)</th>
<th>3 (%)</th>
<th>4 (%)</th>
<th>5 (%)</th>
<th>Mean</th>
<th>SD</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improved efficiency</td>
<td>-</td>
<td>2.4</td>
<td>7.1</td>
<td>40.5</td>
<td>50.0</td>
<td>4.38</td>
<td>0.73</td>
<td>1</td>
</tr>
<tr>
<td>Visual aid</td>
<td>-</td>
<td>-</td>
<td>11.9</td>
<td>54.8</td>
<td>33.3</td>
<td>4.21</td>
<td>0.65</td>
<td>2</td>
</tr>
<tr>
<td>Standardization of routine tasks</td>
<td>-</td>
<td>4.8</td>
<td>9.5</td>
<td>57.1</td>
<td>28.6</td>
<td>4.10</td>
<td>0.76</td>
<td>3</td>
</tr>
<tr>
<td>Co-ordination of all design information</td>
<td>-</td>
<td>2.4</td>
<td>19.0</td>
<td>61.9</td>
<td>16.7</td>
<td>3.93</td>
<td>0.68</td>
<td>4</td>
</tr>
</tbody>
</table>

Table 4. Benefits of BIM to quantity surveying (n=42)
The findings suggest that respondents tended to either agree or strongly agree that BIM would benefit quantity surveying in all the ways indicated in Table 4 with means ranging from 3.51 to 4.38. Improved efficiency (mean=4.38) was the most dominant benefit derived from BIM and cost effectiveness and efficiency was the least dominant benefit (Mean=3.51). Of particular interest is that even though most respondents agreed that accurate measurement could be achieved through the use of BIM, this was not the most dominant benefit suggesting that respondents still see this aspect of their activities remaining traditional.

**Barriers of BIM**

Respondents were presented with eight barriers of BIM to quantity surveying and were asked to indicate their level of agreement on a 5-point Likert scale where 1=strongly disagree, 2=disagree, 3=neutral, 4=agree and 5=strongly agree. Their responses ranked by the means are shown in Table 5.

<table>
<thead>
<tr>
<th>Barriers</th>
<th>1 (%)</th>
<th>2 (%)</th>
<th>3 (%)</th>
<th>4 (%)</th>
<th>5 (%)</th>
<th>Mean</th>
<th>SD</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>High cost/extra capital investment</td>
<td>-</td>
<td>7.3</td>
<td>34.1</td>
<td>41.5</td>
<td>17.1</td>
<td>3.68</td>
<td>0.85</td>
<td>1</td>
</tr>
<tr>
<td>Lack of software application interfaces</td>
<td>-</td>
<td>12.2</td>
<td>41.5</td>
<td>31.7</td>
<td>14.6</td>
<td>3.49</td>
<td>0.90</td>
<td>2</td>
</tr>
<tr>
<td>Software complexity</td>
<td>-</td>
<td>16.7</td>
<td>28.6</td>
<td>45.2</td>
<td>9.5</td>
<td>3.48</td>
<td>0.89</td>
<td>3</td>
</tr>
<tr>
<td>Less familiarity with project</td>
<td>7.3</td>
<td>22.0</td>
<td>26.8</td>
<td>36.6</td>
<td>7.3</td>
<td>3.15</td>
<td>1.09</td>
<td>4</td>
</tr>
<tr>
<td>Lack of standards</td>
<td>4.8</td>
<td>19.0</td>
<td>45.2</td>
<td>28.6</td>
<td>2.4</td>
<td>3.05</td>
<td>0.88</td>
<td>5</td>
</tr>
<tr>
<td>Liability concerns</td>
<td>4.8</td>
<td>26.2</td>
<td>42.9</td>
<td>14.3</td>
<td>11.9</td>
<td>3.02</td>
<td>1.05</td>
<td>6</td>
</tr>
<tr>
<td>Threat to services conventionally provided by quantity surveyors</td>
<td>14.3</td>
<td>35.7</td>
<td>33.3</td>
<td>9.5</td>
<td>7.1</td>
<td>2.60</td>
<td>1.08</td>
<td>7</td>
</tr>
<tr>
<td>Removed need for a quantity surveyan</td>
<td>35.7</td>
<td>38.1</td>
<td>9.5</td>
<td>11.9</td>
<td>4.8</td>
<td>2.12</td>
<td>1.17</td>
<td>8</td>
</tr>
</tbody>
</table>

From the findings in Table 5 it is evident that respondents tended to agree that the high cost and extra capital investment involved would be the largest barrier to adopting BIM by quantity surveyors (mean=3.68). They tended to disagree with the perceptions that BIM would remove the need for a quantity surveyor (mean=2.12) or present as a threat to services conventionally provided by quantity surveyors (mean=2.60) suggesting that quantity surveyors have not fully realized the benefits, barriers and applications of BIM and how it could possibly change the roles and responsibilities of quantity surveyors. They were somewhat neutral about the other barriers (means from 3.02-3.49).
Determinants of BIM usage

Respondents were asked to rank the significance of six determinants of the use of BIM in quantity surveying practices in ascending order from 1 to 6 with 1 being most significant. The rankings are shown in Table 6.

<table>
<thead>
<tr>
<th>Determinants of BIM usage</th>
<th>Mean</th>
<th>SD</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Performance expectancy</td>
<td>3.00</td>
<td>1.67</td>
<td>1</td>
</tr>
<tr>
<td>Effort expectancy</td>
<td>3.21</td>
<td>1.32</td>
<td>2</td>
</tr>
<tr>
<td>Top management support</td>
<td>3.40</td>
<td>1.77</td>
<td>3</td>
</tr>
<tr>
<td>Facilitating conditions</td>
<td>3.90</td>
<td>1.16</td>
<td>4</td>
</tr>
<tr>
<td>Social influence</td>
<td>3.98</td>
<td>1.51</td>
<td>5</td>
</tr>
<tr>
<td>Individual resistance to change</td>
<td>4.02</td>
<td>1.79</td>
<td>6</td>
</tr>
</tbody>
</table>

From Table 6 it is evident that respondents regarded the degree to which a particular BIM would help individuals attain gains in their employment (Performance expectancy) as the most significant determinant of BIM usage in quantity surveying practices. The degree of ease associated with use of the system (Effort expectancy) was the next most significant determinant. Of the six determinants Individual resistance to change was ranked the lowest.

7. CONCLUSIONS

The study found that the knowledge that quantity surveyors had about BIM, software and innovation was at best rather average. They recognized the most obvious benefits of embracing BIM such as the time taken to produce Bills of Quantities which intuitively they still regard as one of their core services to the construction industry. Similarly, more accurate cost estimation was attractive. Largely because of their lack of knowledge of available technologies they could not comment assertively on many of the issues surrounding the relationship between BIM and quantity surveying. This further resonates with the uncertainty that exists surrounding BIM and its business value and return on investment. They, however, recognized the potential that BIM might have on various somewhat routine activities that quantity surveyors get involved with. The greatest inhibitor to BIM uptake was the perceived high cost and extra capital needed. They disagreed that technological advancements presented threats to their existence or the services that they traditionally offered. What would enhance the uptake of BIM was the individual gains that could possibly be achieved through mundane and tedious tasks becoming easier and quicker. In the main the findings of the study resonated with those of other studies done particular in developing countries.
8. REFERENCES


The Evolving Competencies of Quantity Surveyors

Mdunyiswa Mfundo Wanda1, Vittorio Tramontin2, Theo C. Haupt3

1 mdu.ka.da@gmail.com, 2 Tramontin@ukzn.ac.za, 3 Haupt@ukzn.ac.za

1, 2, 3 University of KwaZulu-Natal, School of Engineering, Property Development Programme, Howard College Campus, Durban 4041, South Africa.

ABSTRACT AND KEYWORDS

Purpose of this paper: Given that the construction industry is dynamic and subject to rapid and evolutionary change, there is a need for quantity surveyors and the quantity surveying profession to respond in order to remain relevant. This study aims to identify those competencies and skills that are required by quantity surveyors to achieve this goal.

Design/methodology/approach: This study involves a comprehensive review of relevant literature and previous studies on quantity surveyors’ competencies and skills as a first step to engaging with practicing quantity surveyors and the quantity surveying discipline with respect to the pervasiveness of the identified competencies and skills.

Findings: The traditional competencies and skills required by quantity surveyors have evolved significantly over the years with many of these no longer the focus of the discipline. The literature shows clearly that new competencies and skills are required. Measurement, for example, is almost certainly to become an automated function within a BIM model. However, building models will still need cost management input from the quantity surveyor in order to safeguard client interests.

Research limitations: The literature is confined to studies that concentrated on quantity surveying practices and past, evolving and emerging roles, competencies and skills.

Practical implications: The identification of the requisite competencies and skills required by quantity surveyors is necessary to develop necessary interventions and curriculums that equip graduates adequately for the world of work and professional practice and provide the basis of further Continuing Professional Development (CPD).

Response to the conference theme: Investigating the evolving competencies and skills of quantity surveyors is critical towards improving relevant Higher Education curricula in order to provide high-skilled
graduates who are able to promote a renaissance of the local construction industry.

Keywords: Quantity Surveying, Competencies, Skills.
Conference Sub-Theme: Construction Education.

1. INTRODUCTION

Quantity Surveyors (QS) have played important roles in the construction industry and their clients include developers, government bodies and agencies, building proprietors, architects and contractors. They can be involved in cost planning, cost management, project procurement, contract administration, feasibility studies and asset financial management (Shafiei and Said, 2008).

The environmental influences from the constantly changing construction business environment have caused quantity surveyors to adapt and evolve over time in order to survive and prosper. In order for the quantity surveyors to survive and prosper in the evolving environment, they depend on the knowledge base and appropriate range of competencies of the profession (Sonson and Kulatunga, 2015; Nkado, 2001).

According to the Royal Institution of Chartered Surveyors (RICS, 2009), academics are interested in producing a rounded graduate with the basic foundation knowledge for further development, whereas professional bodies are interested in graduates capable of progression to full professional status through the achievement of the required competencies while at higher education institutions (HEIs). The likely consequence is that there might be a risk of misalignment between what is expected by the professional councils and what is produced by the HEIs. Where employers/regulatory bodies and HEIs work together to promote and sustain employability measures and other forms of collaboration, they tend to move towards a strategy-led, rather than project-led, approach sustained by a central support service that supports educational developments in the whole curriculum. Studies on the impact of higher education programmes to improve employability have found a positive impact on employers and their employees which extends beyond enhancing an individual’s skills to ‘the exchange or generation of new knowledge’ (Nixon, 2002).

The present education system for QS does not recognise these multi-directional needs and often produces a graduate whom the industry sees as not fulfilling their requirements. However, the research literature strongly indicates that, while progress has been made concerning HEI responses to employers’ needs, there is still much to be done to foster a shared understanding across employers, HEIs and regulatory bodies of graduate employability and how to promote it (Parera, Pearson and Dodds, 2010; Nixon 2002).
According to Gunn, *et al.* (2010), while those responsible for higher education provision agree that universities should take into account students’ employment needs ‘including the generic skills and abilities needed in the workplace’ (Gunn, *et al*., 2010: 1) and reflect these skills and abilities in the curriculum and course design, tensions remain because of academic concerns that engaging with the employability agenda will lead to a diminution of academic standards and objectives.

The identification of the competencies and skills required by quantity surveyors will enable the quantity surveying profession to meet changing client and industry needs. The growth of the market for quantity surveying services depends on the knowledge base of the profession (Nkado, 2001). This knowledge base, which should be mainly provided through higher education, must therefore align to these needs which are changing and evolving as also highlighted by previous studies (Ashworth *et al*., 2013).

The paper is based on a thorough review of the literature on competencies and skills of quantity surveyors, using primarily journal articles, papers from conference proceedings, and reports from Councils, both from local and international context. The literature review focuses firstly on the competencies and skills required traditionally by the QS, and their evolution in order to meet the emerging and changing needs of the construction industry. The study is part of a larger research aimed to find possible ways of improving relevant higher education curricula in KwaZulu-Natal (South Africa) in order to prepare graduates in quantity surveying according to the evolving competencies and skills required by the industry.

### 2. COMPETENCIES AND SKILLS REQUIRED BY QUANTITY SURVEYORS

Formal measures of competencies and skills require definition and classification, type and extent. However, the general literature on quantity surveying skills and competencies illustrates a multiplicity of perspectives (Dada, 2014). Many authors consistently use ‘competency’ when referring to occupational competence (Winterton, Le Deist, and Stringfellow, 2006). Therefore, this study mainly refers to the “competencies” of quantity surveying profession as identified by the available literature.

According to Parera, *et al.* (2007), a skill is an ability to perform a task that can be utilised in other occupations. It can be innate or acquired, and applied to general or specific aspects of the work. Innate skill reflects the powers of the human being to think and reason; an acquired skill is that which gains or acquired by education, training and experience. Innate and acquired skills are applied within the domain of knowledge either in a general or specific manner.

Holmes and Joyce (1993) and Babalola (2009, as cited in Dada, 2014) viewed competencies as a description of actions, behaviours or outcomes which a person should be able to demonstrate, or the abilities to transfer...
skills and knowledge to new situations within the occupational area. Therefore, “competency” generally has a broader meaning which relates skills and knowledge to actions and behaviours in an occupational environment. When relating this view to quantity surveying, a competent quantity surveyor is a person who is expected to possess a range of skills, knowledge and understanding and be able to apply these skills and knowledge in a range of contexts and organizations (Dada, 2014).

In the light of this definitions, Parera, et al. (2007) identified the following skills required by Quantity Surveyors:

- Quantification,
- Documentation,
- Appraisal/Evaluation,
- Interpersonal skills,
- Analysis,
- Communication,
- Computer Literacy,
- Synthesis,
- Management, and
- Self-Development and Leadership.

These skills are functional to specific competencies required by the quantity surveying profession:

- Cost Estimating,
- Government Regulations and Law,
- Cost Planning,
- Contract Documentation,
- Measurement,
- Valuation,
- Cost Information data base,
- Quality Assurance,
- Construction Technology,
- Computer Applications, and
- Bills of Quantities (Ibid).

According to Nkado (2001), a helpful framework was proposed by Meyer and Semark (1996) for the identification and assessment of competencies when they suggested four consecutive levels of competencies, namely national, organisational, occupational and generic meta-competencies. Each competence level is supported by those below it, which suggests that an improvement at the level of occupational competencies for the profession of quantity surveying will ultimately and positively impact on the national competencies of South Africa.

When looking at the international context, there was discontent with the role of RICS in Quantity Surveying education as well as their communication and engagement strategies. There was also a good deal of satisfaction expressed (specifically by academics) on the RICS partnership process in accreditation of programmes (Nkado, 2001). However, this is not
to say that there is no scope for improvement (Parera, Pearson, and Dodds, 2010). The Royal Institution of Chartered Surveyors (RICS, 1998; 2014) set out the requirements and competencies for the assessment of professional competence by listing the competencies required by QS into three distinct categories (basic, core and optional) as shown in Table 1.

Table 1: Competencies required by QS

<table>
<thead>
<tr>
<th>BASIC COMPETENCIES</th>
<th>CORE COMPETENCIES</th>
<th>OPTIONAL COMPETENCIES</th>
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<tbody>
<tr>
<td>Personal and interpersonal skills</td>
<td>Team working</td>
<td>Construction Contract Practice</td>
</tr>
<tr>
<td></td>
<td>Communication and negotiation</td>
<td></td>
</tr>
<tr>
<td>Mapping</td>
<td>CONSTRUCTION TECHNOLOGY AND ENVIRONMENTAL SERVICES</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Business planning</td>
<td>Economic of Construction</td>
</tr>
<tr>
<td></td>
<td>Client care</td>
<td></td>
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<tr>
<td></td>
<td>Accounting principles and procedures</td>
<td></td>
</tr>
<tr>
<td>Professional Practice</td>
<td>Ethics and professional practice</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Conduct rules</td>
<td></td>
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<tr>
<td>Law</td>
<td>Insurance</td>
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<td></td>
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<tr>
<td>Measurement</td>
<td>Project Management</td>
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<tr>
<td></td>
<td>Health and safety</td>
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<tr>
<td></td>
<td>Property Investment Funding</td>
<td></td>
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<tr>
<td></td>
<td>Research Methodologies and Techniques</td>
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<td></td>
<td>Taxation Allowances and Grants</td>
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<tr>
<td></td>
<td>Sustainability</td>
<td></td>
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<td></td>
<td>BIM management</td>
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</tr>
</tbody>
</table>

Sources: RICS (1998; 2014)

The basic competencies are common to all construction professions under the RICS structure. The core competencies are uniquely required of quantity surveyors, while the optional competencies reflect mainly the
evolved roles and some emerging roles (Nkado, 2001; Sonson, et al., 2015) (Table 1).

The main aim of the table above is to show the differences between the RICS’s basic, core and optional competencies outlined in 1998 and 2014, and to introduce these competencies that will later be compared as identified and categorised by other authors. In Table 1, each category of competencies (basic, core, optional) shows how the relevant competencies evolved from 1998 to 2014. Most basic and core competencies have not changed significantly, except that some of them were very broad in 1998, therefore a further diversification was necessary, also following the increasing specialisation of professions in construction. However, in most cases the specialisation occurred within the same area of expertise. This is the case, for example, of the basic competency Business skills, which over time expanded and diversified into Business planning, Client care, Accounting principles and procedures. From 1998 to 2014, following the changing needs and requirements of industry and clients, some of the competencies moved from one category to another, evolving from a general/basic relevance to a core/critical importance for QS. For example, the basic broad competency Measurement in 1998 evolved to the core competency Quantification and costing of construction works in 2014. From the analysis of the table above, the competencies that seem to represent new fields of expertise for QS in the contemporary construction industry are primarily related to Health and Safety, Building Information Modelling and Management, and Sustainability of construction. The comparison of the literature from other authors later in the paper will focus more in depth on the amount of shifts between categories that have taken place and the competencies that are expected to be more relevant in the near future.

Ashworth, et al. (2013) commented that the distinctive competencies as listed by RICS in 1998 provided the quantity surveyor with the basis for the cost management of the construction project in the context of forecasting, analysing, planning, controlling and accounting. They refer to these activities as the ‘traditional role’ of QS, and that these services are still provided by some practices on medium and small scale projects. However, various factors have operated to bring about significant change within the quantity surveying profession (Ibid.).

The findings of the 1991 Davis, Langdon Everest report, QS 2000, identified changing client needs and attitudes, changing markets and business practice, a changing and more managerial industry, a changing quantity surveying profession, as well as the impact of information technology as drivers for diversification and expanding the range of services offered by the industry. In particular, the declining use of bills of quantities, which traditionally formed the principle source of fee income as a significant contributing factor in this process (Ibid.).

Quantity surveyors typically offered procurement advice in response to the increasing range of available options. Design cost planning coupled with whole life costing, value management and risk analysis and management
add value to the services being offered in order to achieve client objectives. Quantity surveyors also have become more involved in the measurement and valuation of engineering services which traditionally had been dealt with through prime cost and provisional sums. Other evolved competencies include contractual dispute resolution, project and construction management and facilities management (Ibid.).

According to Parera, et al., (2007), the analysis and the interpretation of competencies also reveal that there is no clear prescribed level of expectation of the level of achievement of competencies by graduates. This view is at present open to interpretation as both academia and industry interpret completely different expected levels of satisfaction of competencies. This conflict in itself is a source of friction and dissatisfaction both on the part of industry and academia. It begs the question that if there is no bench mark to say that graduate quantity surveyors should have achieved different competencies at a certain level then it is open for interpretation and one would naturally have to expect different standards.

In South Africa, the South African Council for the Quantity Surveying Profession (SACQSP) plays a role in Quantity Surveying education when it comes to accreditation of programmes. The council provides a list of mandatory criteria or unit standards that HEI undergraduate programmes must comply with to be accredited. These criteria are summarised in Table 2. The modules offered by the Quantity Surveying undergraduate programmes in South Africa must deploy and develop these standards. In order to provide an example, each criterion identified by SACQSP is cross-mapped in the following Table 2 with the module or modules that deploy it at each of the three Quantity Surveying teaching HEIs in the Province of KwaZulu-Natal at undergraduate level, namely University of KwaZulu-Natal (UKZN), Durban University of Technology (DUT) and Mangosuthu University of Technology (MUT).

**Table 2: Comparison between SACQSP Accreditation Criteria and relevant undergraduate modules at the HEIs in KwaZulu-Natal (South Africa) offering QS programmes**

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Construction Technology (construction methods and services)</td>
<td>Construction Technology and Processes 1A to 3A</td>
<td>Construction Technology 1-3</td>
<td>Construction Technology 1-3</td>
</tr>
<tr>
<td>Procurement</td>
<td>Construction Contracts</td>
<td>Construction Technology 1 and 3</td>
<td>Construction Technology 1 and 3</td>
</tr>
<tr>
<td>Mathematical systems for Commercial applications</td>
<td>Quantitative Methods</td>
<td>Applied Building Science 1</td>
<td>Applied Building Science 1</td>
</tr>
<tr>
<td>Measurement</td>
<td>Design Appraisal and Measurement- Intro. to 3B</td>
<td>Quantity Surveying 1-3</td>
<td>Quantity Surveying 1-3</td>
</tr>
<tr>
<td>Project Resources</td>
<td>Construction Technology and Processes 1A to 3A</td>
<td>Applied Building Science 1</td>
<td>Applied Building Science 1</td>
</tr>
<tr>
<td>Economic concepts central to local economic development</td>
<td>Principles of Micro/Macroeconomics (Addressed at Postgraduate level)</td>
<td>(Addressed at Postgraduate level)</td>
<td>(Addressed at Postgraduate level)</td>
</tr>
<tr>
<td>Built Environment Budgetary</td>
<td>Intro to Built Environment (Addressed at Postgraduate level)</td>
<td>(Addressed at Postgraduate level)</td>
<td>(Addressed at Postgraduate level)</td>
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<tr>
<td>Project Management</td>
<td>Project Management/Planning</td>
<td>Construction Management 1-3</td>
<td>Construction Management 1-3</td>
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<tr>
<td>Subject</td>
<td>Course/Module</td>
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<td>-------------------------------------------------------------------------------</td>
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</tr>
<tr>
<td>South African Law</td>
<td>Introduction to Law, Aspects of South African Law, and Property Law</td>
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</tr>
<tr>
<td>Feasibility and Viability</td>
<td>Reporting</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Construction drawings and</td>
<td>Construction drawing/Technology and Processes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Financial Accounting</td>
<td>Financial Reporting 1A and Accounting 103</td>
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</tr>
<tr>
<td>Financial statements/Financial</td>
<td>Construction Accounting 3</td>
<td></td>
<td></td>
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<tr>
<td>Investment Techniques</td>
<td>(Addressed at Postgraduate level)</td>
<td></td>
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<tr>
<td>Macroeconomics principles/</td>
<td>Property studies</td>
<td></td>
<td></td>
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<tr>
<td>Microeconomic principles</td>
<td>Principles of Micro/Macroeconomics</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Labour legislation on</td>
<td>Property Law</td>
<td></td>
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<tr>
<td>business practice</td>
<td>Construction Management 1-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cost Estimating</td>
<td>Design Appraisal and Measurement-Intro. to 3B</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Payment Processes</td>
<td>(Addressed at Postgraduate level)</td>
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</tr>
<tr>
<td>Cost Planning</td>
<td>Design Appraisal and Measurement-Intro. to 3B</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contractual Management</td>
<td>Construction Contracts</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The criteria listed in Table 2 focus on the knowledge base, which should be mainly provided through higher education, and must therefore align to the clients’ needs in the construction industry which are changing and evolving as also highlighted by previous studies (Ashworth, et al., 2013). The purpose of Table 2 is only to show the response of the quantity surveying HEIs in KwaZulu-Natal to the accreditation assessment criteria required by the SACQSP, in the light of contrasting the importance of introducing the evolving roles and competencies of QS (outlined in Table 3) as expected by the construction industry. The alignment with the accreditation criteria does not necessarily reflect a real response of HEIs to the need of QS for evolving their roles and competencies in order to respond to the dynamics of the construction industry. Due to the demands of the construction industry, there are now shifts and evolution in competencies which should be taken into consideration by HEI programmes in order to provide graduates with the necessary competencies to work effectively in the 21st century construction industry.

### 3. COMPARATIVE ANALYSIS OF QUANTITY SURVEYING COMPETENCIES

A review of the literature clearly shows that there is no exact consensus among researchers as to what competencies are most important for quantity surveying graduates and arguably for all QS. The role of the quantity surveyor continues to evolve in response to the ever-changing business environment and rising client expectations.
Table 3 shows the comparison between competencies (basic, core and evolving) as identified by renowned authors on the context of quantity surveying competencies over the past decade. According to Nkado (2001), the evolving competencies, in particular, reflect areas of specialisation or future career diversification. Each row of the table refers to a specific competency and shows the acknowledgement of its relevance amongst the various authors.

Table 3: Cross comparative analysis of Quantity Surveying competencies (Basic, Core and Evolving)

<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>Business management</td>
<td>Business skills</td>
<td>Client care</td>
<td>Employers’ agent</td>
<td>Consultancy services</td>
</tr>
<tr>
<td>Contract Documentation</td>
<td>Contract administration</td>
<td>Subcontract administration</td>
<td>Contract administration</td>
<td></td>
</tr>
<tr>
<td>Construction Technology</td>
<td>Construction technology and environmental services</td>
<td>Construction technology and environmental services</td>
<td>Construction technology and environmental services</td>
<td></td>
</tr>
<tr>
<td>Cost estimating</td>
<td>Quantification and costing of construction works</td>
<td>Environmental services measurement and costing</td>
<td>Quantification and costing of construction works</td>
<td></td>
</tr>
<tr>
<td>General procurement advice</td>
<td>Procurement management</td>
<td>Procurement tendering</td>
<td>Procurement and tendering</td>
<td></td>
</tr>
<tr>
<td>Financial management</td>
<td>Project financial control and reporting</td>
<td>Value management</td>
<td>Project financial control and reporting</td>
<td></td>
</tr>
<tr>
<td>Cost planning</td>
<td>Business planning</td>
<td>Cost modelling/Advice on cost limits and budgets</td>
<td>Cost planning</td>
<td></td>
</tr>
<tr>
<td>Construction contract practice</td>
<td>Contract practice</td>
<td>Contract practice</td>
<td></td>
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<tr>
<td>LIFE CYCLE COST ANALYSIS</td>
<td>Whole life costing</td>
<td>Whole life costing assessment</td>
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</tr>
<tr>
<td>STRATEGIC PLANNING</td>
<td>Planning and supervision/ Planning supervisor</td>
<td>Strategic management and leadership</td>
<td></td>
<td></td>
</tr>
<tr>
<td>COMPUTER APPLICATIONS</td>
<td>Data management</td>
<td>Programming management</td>
<td>BIM management</td>
<td></td>
</tr>
<tr>
<td>SUSTAINABILITY</td>
<td>Sustainability</td>
<td>Sustainability advisor</td>
<td>Sustainability</td>
<td></td>
</tr>
<tr>
<td>FINANCIAL AUDIT</td>
<td>Accounting principles and procedures</td>
<td>Technical auditing</td>
<td></td>
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<tr>
<td>VALUATION</td>
<td>Project Evaluation</td>
<td></td>
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<tr>
<td>TAXATION</td>
<td>Capital allowances</td>
<td></td>
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<tr>
<td>COMPLIANCE ISSUES AND QUALITY ASSURANCE (ISO STANDARDS)</td>
<td>Due diligence</td>
<td></td>
<td></td>
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<tr>
<td>COMMUNICATION AND NEGOTIATION</td>
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<tr>
<td>HEALTH AND SAFETY</td>
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<tr>
<td>TEAM WORKING</td>
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</table>
The findings on the basic competencies shows that the authors were in consensus that all the Built Environment professionals need to be competent in business management, contract administration and construction technology. Even though RICS considers the last two primarily as core competencies of QS, it can be stated that according to the researchers, over the past decade these competencies have generally been acknowledged to constitute the foundations of construction professions. To these core competencies identified by researchers, Health and Safety should be added (although only one author listed it, further to this within the evolving ones), following the recent recommendations provided by RICS.

The core competencies are expanding and have changed as compared to those outlined by RICS in the past. Basic (measurements) and evolving (financial management) competencies in the past have now become core competencies (quantification and costing, financial management). Other competencies generally recognised by the literature to be core for QS, also in line with RICS, are construction economics and cost planning, procurement and tendering, and contract practice. However, it is likely that in the near future more and more evolving competencies will become core competencies, particularly those related to emerging client demand, to sensitive topics for the contemporary society and to the rapid evolution of information technology which also affects the innovation of project delivery systems. This shift can be predicted for the evolving competencies on which there is recently a greater consensus amongst authors, particularly sustainability, BIM, whole life cycle costing, strategic management and financial auditing.

Quantity Surveyors therefore face the challenge to equip themselves with these new competencies in order to stay relevant in the future construction industry. Other least recognised evolving competencies such as mapping and logistics, quality assurance standards, maintenance programmes, capital allowance and valuation seem to be expected to maintain the role of potential future career diversification on the basis of future specific demand.
4. CONCLUSIONS

Given that the construction industry is dynamic and subject to rapid and evolutionary change, the role of the quantity surveyor continues to evolve in response to the ever changing business environment and to rising client expectations. Quantity Surveyors respond with basic, core and evolving competencies to stay relevant. Available literature and previous studies on competencies and skills of QS were analysed and discussed. The limited literature on quantity surveying competencies in the South Africa context posed a limitation on this review study.

This study points out areas that should be deployed and developed by the SACQSP, HEIs and Construction Industry role players for Continuing Professional Development and for equipping QS graduates. For this to be achieved, HEIs, Professional Council and Associations need to work together to ensure employability of graduates by the alignment of changing and evolving needs for QS. The demanded attributes of quantity surveyors revolve around the development of new competencies and skills in meeting new clients’ expectations, technology innovation and global challenges for the contemporary society.

In analysing the literature, the research studies were cross compared and a conclusion was drawn that the traditional competencies (basic and core) are still the heart of quantity surveying both locally and abroad. However, core competencies are rapidly evolving and might require in the near future other skills and competencies for QS to be relevant. The evolving competencies, mainly the information technology and sustainability driven ones, are highly growing, but not yet manifested by many quantity surveying practices and relevant HEI programmes in South Africa. The next big challenge for the quantity surveying profession and relevant tertiary education programme is ‘how’ to acquire the most important evolving competencies through higher education and professional skills training.

Furthermore, the various tables illustrated above indicate that there is no unanimous consensus on what the competencies that QS need to have, which makes it difficult to design a curriculum unless one focuses on those competencies that are most easily transferable to dynamically changing environments. Further ongoing researches will produce an overview of the perceptions related to Quantity Surveying education and provide a platform for re-direction and re-shape of the relevant education system through evolving competencies.

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The threat of technology to the way quantity surveying is practised in KwaZulu-Natal

Theo C. Haupt1 and Sanjivi Naidoo2
Haupt@ukzn.ac.za 1 and sanjivi@mut.ac.za 2

1 Professor, Construction Studies Program, University of KwaZulu-Natal, Howard College, Durban 4001, South Africa. (Tel: +27 31 2602712)

2 Faculty of Engineering, Department of Construction Management & Quantity Surveying, Mangosuthu University of Technology, Umlazi, Durban 4026, South Africa. (Tel: +27 31 9077557)

ABSTRACT AND KEYWORDS

Purpose: The rapid growth and development of comprehensive user-friendly estimating software has threatened the traditional roles of quantity surveyors in the construction sector resulting in them having to develop alternative services that they render clients. Consequently quantity surveying has experienced significant changes in terms of scope and types of services provided. This study examines the perceived threat of new technological developments on the way that quantity surveyors conduct themselves.

Design/methodology/approach: A sample of 22 quantity surveyors in Durban was surveyed using an quantitative survey instrument developed from published literature on responses of quantity surveying to technology to measure the responses of this sample to the same issues. Knowledge and experience of technology, benefits, barriers and readiness for technological change was examined.

Research limitations: The sample of quantity surveyors was drawn from the Durban area using the Association of Quantity Surveyors (ASAQS) and South African Council for the Quantity Surveying Professions (SACQSP) database.
Findings: Preliminary findings suggest that quantity surveyors are lagging behind with respect to their adoption of technology due to high cost of hardware and software.

Response to conference theme: This study identifies the reasons why the adoption of technology by quantity surveyors is not pervasive throughout the discipline.

Practical implications: The findings provide the opportunity to improve the services currently offered by quantity surveyors but also new and innovative services driven by technological developments

Keywords: Quantity surveying, computer technology, computer hardware, computer software

Conference sub-theme: Construction Education

1. INTRODUCTION

The rapid growth and development of comprehensive user-friendly estimating software has threatened the traditional roles of quantity surveyors in the construction sector (Ashworth, Hogg and Higgs, 2013). Consequently quantity surveying has experienced significant changes in terms of scope and types of services provided. Rapid technological innovative practices are being developing to achieve competitive advantage (Kulasekara, Jayasena, and Ranadewa, 2013). Technology has the potential to remove many mundane elements of traditional quantity surveying by automating or assisting in these tasks while removing human error, increasing efficiency and promoting collaboration (Zhou, Perera, Udeaja and Charlotte, 2012). This study examines the perceived threat of new technological developments on the quantity surveying discipline.

2. ROLE OF QUANTITY SURVEYORS

Quantity surveyors are regarded as the cost managers of construction works in all sectors of the construction industry particularly in regions where there has been a historic relationship with the United Kingdom. According to Ashworth (2010) and Ashworth, Hogg and Higgs (2013), the traditional quantity surveying roles are, namely

- Single rate approximate estimation;
- Cost planning;
- Procurement advice;
- Measurement and quantification;
- Document preparation, especially bills of quantities;
• Cost control during construction;
• Interim valuations and payments;
• Financial statements;
• Final account preparation and agreement;
• Settlement of contractual claims.

Following the potential demise of bills of quantities additional and potential new roles evolved and include the following, namely:

• Investment appraisal;
• Advice on cost limits and budgets;
• Whole life costing;
• Value management;
• Risk analysis;
• Insolvency services;
• Cost engineering services;
• Subcontract administration;
• Environmental services measurement and costing;
• Technical auditing;
• Planning and supervision;
• Valuation for insurance purposes;
• Project management;
• Facilities management;
• Administering maintenance programs; and
• Advice on contractual disputes (Ibid).

Other classifications have referred to the roles as being traditional (six roles) (Ashworth, 2010), evolved (ten roles) (Frei and Mbachu, 2009) and emerging (five roles) (Fanous, 2012) with the traditional roles being regarded as the most important (Sonson and Kulatunga, 2014). The list under each classification in order of importance is:

Traditional role
• Quantification and costing of construction works
• Project financial control and reporting
• Procurement and tendering
• Contract practice
• Cost planning
• Construction technology and environmental services

Evolved role
• Valuation (property, rental, etc.)
• Contract administration
• Consultancy services
• Project management
Emerging role
- Whole life costing assessment
- Strategic management and leadership
- Value management studies
- Sustainability
- BIM management [ICT] (Ibid).

From this particular study it is evident that quantity surveyors have not embraced the potential of new technologies. Some of the issues predicted by Harris (2000) that will affect the discipline of quantity surveying include the following, namely:

- Blurring of professional disciplines;
- Wider range of services offered to present clients;
- Application of quantity surveying to new markets;
- More extensive and intensive use of information and communications technology to improve efficiency and effectiveness;
- Changes in professional structure;
- Multi-discipline working and development;
- Increased emphasis on continuing professional development;
- Geographical dispersion of work to allow for the most economical methods of working; and
- Forecasted shift between professional and technical activities.

In this list of issues the increased use of technologies to improve efficiency and effectiveness of quantity surveyors stands out.

3. ADOPTION OF TECHNOLOGY

Ashworth and Hogg (2000) claim that the five most dominant problems of using computers in quantity surveying are maintaining programs, integration of processes, cost containment, recruitment, and meeting project deadlines. Further, benefits of technological advancements for quantity surveyors include:

- Reduction in the amount of time spent on repetitive processes;
- Improvement in methods of communications;
- Enhancement in the quality of the services provided;
• Development of a broader range of services; and
• Speed in the execution of tasks (Ibid).

Technology enables collaboration between users through better visual understanding of the building artifact (Matipa, Cunningham and Naik, 2010). Ashworth, Hogg and Higgs (2013) predicted that the broadening range of quantity surveying functions will include automated measurement and quantification, environmental and sustainability analysis, facilities management, legal services, investment advices and quality management. It has been found that the emergence of new and updated technologies make the achievement of these functions more efficient (Wu, Wood, Ginige and Jong, 2014).

Several studies have found that the level of the adoption of information technologies was positively associated with improved performance (Kang, O’Brien, Thomas, and Chapman, 2008). Usman, Said and Yahaya (2012) argue that despite these benefits quantity surveyors have not been taking serious action towards adopting new technologies. Where they have been used they have been at the basic stages only with no advancement into the usage of sophisticated software because of the negative perceptions and fraudulent activities. The construction industry, and by inference quantity surveying, has been found repeatedly to be reluctant to apply new technologies and employs lower levels of technology than other industries (Yang, 2007). Further, organizations tended to resist giving up and changing established ways of doing things and familiar technology products (Lawrence and Scanlan, 2007). This tendency is referred to as organizational inertia.

According to Venkatesh, Morris, Davis and Davis (2003) direct determinants of user acceptance of technology and usage behavior were likely to be

• performance expectancy - degree to which a particular technology will help individuals attain gains in job performance;
• effort expectancy - degree of ease associated with use of the system;
• facilitating conditions - degree to which an individual believes that organizational and technical infrastructure exists to support use of the system;
• social influence - degree to which an individual perceives that important others believe he or she should use the new system;
• top management support; and
• individual resistance to change.

A study in Nigeria found that the greatest challenges reported as deterrents to the increased uptake of technology by quantity surveyors were the high cost of hardware and the fear of virus attacks (Oyewobi, Ibironke and Oladosu, 2015).
It is therefore important that quantity surveyors appreciate technology, understand their potential and develop and employ effective processes and tools to integrate technologies into their current practices (Cartlidge, 2011).

4. RESEARCH APPROACH

A convenience sample of 22 quantity surveyors who were either employed in quantity surveying practices or practicing for themselves in the Durban area of the KwaZulu-Natal province of South Africa were surveyed about their views of the threat of technology to the discipline and practice of quantity surveying. The data were collected via a quantitative questionnaire survey comprising of several sections such as knowledge and experience of technology, benefits, barriers and readiness. Almost all questions took the form of statements around the various themes which required a scaled response of agreement. Descriptive statistics were derived using SPSS v23 and presented including measures of central tendency and dispersion. The internal validity of scaled responses was determined by the Cronbach’s alpha co-efficient for validity.

5. RESEARCH FINDINGS

Profile of respondents

Most respondents had been in business for between 1 to 10 years (63.6%) and between 11 to 20 years (31.8%). Just more than half of the respondents (57.1%) considered their practices or firms ready for technology. They rated their knowledge and experience of technology, software and innovation as shown in Table 1 with 1=very low and 5=very high.

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge</td>
<td>4.5</td>
<td>18.2</td>
<td>40.9</td>
<td>31.8</td>
<td>4.5</td>
<td>3.14</td>
<td>0.94</td>
</tr>
<tr>
<td>Experience</td>
<td>4.5</td>
<td>31.8</td>
<td>36.4</td>
<td>23.4</td>
<td>-</td>
<td>2.86</td>
<td>0.89</td>
</tr>
</tbody>
</table>

Respondents tended to have average knowledge (mean 3.14) and experience (mean=2.86) of technology, software and innovation. Almost all respondents (95.5%) expressed that they were open to the introduction and adoption of new technology to quantity surveying despite the threats that it might present.
Reliability

Table 2 shows the Cronbach's alpha co-efficient for the scaled responses of each of the four constructs. There is an acceptable degree of internal consistency for the scales used for all the constructs, namely a Cronbach Alpha statistic which is greater than the rule-of-thumb 0.70 for acceptable internal scale consistency. There is therefore between 71.2% and 90.1% probability that the constructs each measure a single underlying concept with an error of at most 5%. The scales used to measure the perceptions of technology in quantity surveying are therefore acceptable in their measure of the reliability of the constructs.

Table 2. Reliability statistics

<table>
<thead>
<tr>
<th>Construct</th>
<th>Cronbach's alpha co-efficient (n=22)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technology and quantity surveying</td>
<td>0.712 (25 items)</td>
</tr>
<tr>
<td>Benefits of technology</td>
<td>0.857 (8 items)</td>
</tr>
<tr>
<td>Barriers of technology</td>
<td>0.863 (8 items)</td>
</tr>
<tr>
<td>Knowledge and experience</td>
<td>0.901 (2 items)</td>
</tr>
</tbody>
</table>

Technology and quantity surveying

Respondents were presented with 25 statements about technology and quantity surveying and were asked to indicate their level of agreement on a 5-point Likert scale where 1=strongly disagree, 2=disagree, 3=neutral, 4=agree and 5=strongly agree. The findings are shown in Table 3 ranked by the means of their responses.

Table 3. Technology and quantity surveying (n=22)

<table>
<thead>
<tr>
<th>Factor/Influence</th>
<th>1 (%)</th>
<th>2 (%)</th>
<th>3 (%)</th>
<th>4 (%)</th>
<th>5 (%)</th>
<th>Mean</th>
<th>SD</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Software reduces the time to produce BoQs</td>
<td>-</td>
<td>-</td>
<td>4.5</td>
<td>36.4</td>
<td>59.1</td>
<td>4.55</td>
<td>0.60</td>
<td>1</td>
</tr>
<tr>
<td>Technology increases efficiency of quantity surveying</td>
<td>-</td>
<td>-</td>
<td>13.6</td>
<td>54.5</td>
<td>31.8</td>
<td>4.18</td>
<td>0.66</td>
<td>2</td>
</tr>
<tr>
<td>Technological advances require new skills and knowledge</td>
<td>-</td>
<td>9.1</td>
<td>9.1</td>
<td>40.9</td>
<td>40.9</td>
<td>4.14</td>
<td>0.94</td>
<td>3</td>
</tr>
<tr>
<td>Cost estimation can be improved</td>
<td>-</td>
<td>13.6</td>
<td>-</td>
<td>50.0</td>
<td>36.4</td>
<td>4.09</td>
<td>0.97</td>
<td>4</td>
</tr>
<tr>
<td>Technology allows the quantity surveyor to focus on strategic activities</td>
<td>-</td>
<td>4.5</td>
<td>13.6</td>
<td>54.5</td>
<td>27.3</td>
<td>4.05</td>
<td>0.79</td>
<td>5</td>
</tr>
<tr>
<td>Technological innovations promote collaboration between stakeholders</td>
<td>-</td>
<td>4.5</td>
<td>18.2</td>
<td>54.5</td>
<td>22.7</td>
<td>3.95</td>
<td>0.79</td>
<td>6</td>
</tr>
<tr>
<td>Technology enhances life cycle costing data provision to clients</td>
<td>-</td>
<td>4.8</td>
<td>23.8</td>
<td>47.6</td>
<td>23.8</td>
<td>3.90</td>
<td>0.83</td>
<td>7</td>
</tr>
<tr>
<td>Technology automates taking off</td>
<td>4.8</td>
<td>4.8</td>
<td>9.5</td>
<td>57.1</td>
<td>23.8</td>
<td>3.90</td>
<td>1.00</td>
<td>8</td>
</tr>
</tbody>
</table>
and BoQ production

<table>
<thead>
<tr>
<th>Factor/Influence</th>
<th>1 (%)</th>
<th>2 (%)</th>
<th>3 (%)</th>
<th>4 (%)</th>
<th>5 (%)</th>
<th>Mean</th>
<th>SD</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Financial and time commitment from small practices is too large</td>
<td>4.5</td>
<td>13.6</td>
<td>27.3</td>
<td>45.5</td>
<td>9.1</td>
<td>3.41</td>
<td>1.01</td>
<td>13</td>
</tr>
<tr>
<td>Information and Communication Technologies (ICT) are too expensive</td>
<td>4.5</td>
<td>4.5</td>
<td>50.0</td>
<td>36.4</td>
<td>4.5</td>
<td>3.32</td>
<td>0.84</td>
<td>14</td>
</tr>
<tr>
<td>Additional costs of training make technology prohibitive</td>
<td>9.1</td>
<td>13.6</td>
<td>36.4</td>
<td>31.8</td>
<td>9.1</td>
<td>3.18</td>
<td>1.10</td>
<td>15</td>
</tr>
<tr>
<td>Roles and responsibilities of quantity surveyors will change</td>
<td>-</td>
<td>40.9</td>
<td>13.6</td>
<td>31.8</td>
<td>13.6</td>
<td>3.18</td>
<td>1.14</td>
<td>16</td>
</tr>
<tr>
<td>There is a scarcity of available training</td>
<td>4.8</td>
<td>19.0</td>
<td>38.1</td>
<td>33.3</td>
<td>4.8</td>
<td>3.14</td>
<td>0.96</td>
<td>17</td>
</tr>
<tr>
<td>Technology removes human errors from quantity surveying</td>
<td>4.5</td>
<td>27.3</td>
<td>31.8</td>
<td>22.7</td>
<td>13.6</td>
<td>3.14</td>
<td>1.13</td>
<td>18</td>
</tr>
<tr>
<td>Organizational inertia prevents the adoption of new technology</td>
<td>9.1</td>
<td>22.7</td>
<td>22.7</td>
<td>36.4</td>
<td>9.1</td>
<td>3.14</td>
<td>1.17</td>
<td>19</td>
</tr>
<tr>
<td>Quantity surveyors resist the introduction and adoption of new technology</td>
<td>13.6</td>
<td>27.3</td>
<td>13.6</td>
<td>31.8</td>
<td>13.6</td>
<td>3.05</td>
<td>1.32</td>
<td>20</td>
</tr>
<tr>
<td>There are problems with legal ownership of information</td>
<td>-</td>
<td>27.3</td>
<td>54.5</td>
<td>18.2</td>
<td>-</td>
<td>2.91</td>
<td>0.68</td>
<td>21</td>
</tr>
<tr>
<td>Technology reduces the amount of variations during the construction phase</td>
<td>13.6</td>
<td>27.3</td>
<td>31.8</td>
<td>18.2</td>
<td>9.1</td>
<td>2.82</td>
<td>1.18</td>
<td>22</td>
</tr>
<tr>
<td>There is no client demand</td>
<td>18.2</td>
<td>31.8</td>
<td>31.8</td>
<td>18.2</td>
<td>-</td>
<td>2.50</td>
<td>1.01</td>
<td>23</td>
</tr>
<tr>
<td>QS practices are too small to embrace technology</td>
<td>36.4</td>
<td>22.7</td>
<td>27.3</td>
<td>13.6</td>
<td>-</td>
<td>2.18</td>
<td>1.10</td>
<td>24</td>
</tr>
<tr>
<td>Technological developments are only for architects and designers</td>
<td>68.2</td>
<td>22.7</td>
<td>-</td>
<td>9.1</td>
<td>-</td>
<td>1.50</td>
<td>0.91</td>
<td>25</td>
</tr>
</tbody>
</table>

Respondents tended to agree strongly that software would reduce the time to produce Bills of Quantity (mean=4.55). They tended to agree that technology
would increase the efficiency of quantity surveying (mean=4.18) but would require new skills and knowledge (mean=4.14). They also tended to agree that cost estimation could be improved (mean=4.09), technology would allow the quantity surveyor to focus on strategic activities (mean=4.05) and promote collaboration between stakeholders (mean=3.95). Respondents tended to disagree strongly that technological developments were for architects and designers only (mean=1.50). They tended to disagree that quantity surveying practices were too small to embrace technology (mean=2.18). What was noticeable were the large proportions of respondents who had neutral views about several of the issues such as there being problems with legal ownership of information (54.5%) and information and communication technologies being too expensive (50.0%). This finding might be indicative of their lack of knowledge and experience with new technological advances.

Benefits of technology

Respondents were presented with eight benefits of technology to quantity surveying and were asked to indicate their level of agreement on a 5-point Likert scale where 1=strongly disagree, 2=disagree, 3=neutral, 4=agree and 5=strongly agree. Their responses ranked by the means are shown in Table 4.

<table>
<thead>
<tr>
<th>Benefit</th>
<th>1 (%)</th>
<th>2 (%)</th>
<th>3 (%)</th>
<th>4 (%)</th>
<th>5 (%)</th>
<th>Mean</th>
<th>SD</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improved efficiency</td>
<td>-</td>
<td></td>
<td>4.5</td>
<td>31.8</td>
<td>63.6</td>
<td>4.39</td>
<td>0.59</td>
<td>1</td>
</tr>
<tr>
<td>Standardization of routine tasks</td>
<td>-</td>
<td>4.5</td>
<td>45.5</td>
<td>45.5</td>
<td></td>
<td>4.31</td>
<td>0.78</td>
<td>2</td>
</tr>
<tr>
<td>Cost plan production</td>
<td>-</td>
<td></td>
<td>9.1</td>
<td>54.5</td>
<td>36.4</td>
<td>4.27</td>
<td>0.63</td>
<td>3</td>
</tr>
<tr>
<td>Visual aid</td>
<td>-</td>
<td>13.6</td>
<td>31.8</td>
<td>45.5</td>
<td></td>
<td>4.18</td>
<td>0.66</td>
<td>4</td>
</tr>
<tr>
<td>Automatic schedule/program production</td>
<td>-</td>
<td>4.5</td>
<td>13.6</td>
<td>54.5</td>
<td>27.3</td>
<td>4.05</td>
<td>0.79</td>
<td>5</td>
</tr>
<tr>
<td>Co-ordination of all design information</td>
<td>-</td>
<td>4.5</td>
<td>13.6</td>
<td>59.1</td>
<td>22.7</td>
<td>4.00</td>
<td>0.76</td>
<td>6</td>
</tr>
<tr>
<td>Accurate measurement</td>
<td>-</td>
<td>4.5</td>
<td>22.7</td>
<td>45.5</td>
<td>27.3</td>
<td>3.95</td>
<td>0.84</td>
<td>7</td>
</tr>
<tr>
<td>Cost effective</td>
<td>-</td>
<td>4.8</td>
<td>42.9</td>
<td>28.6</td>
<td>23.8</td>
<td>3.71</td>
<td>0.90</td>
<td>8</td>
</tr>
</tbody>
</table>

The findings suggest that respondents tended to either agree or strongly agree that technology would benefit quantity surveying in all the ways indicated in Table 4 with means ranging from 3.71 to 4.39. Improved efficiency (mean=4.39) was the most dominant benefit derived from technology and cost effectiveness and efficiency was the least dominant benefit (Mean=3.71).

Barriers of technology

Respondents were presented with eight barriers of technology to quantity surveying and were asked to indicate their level of agreement on a 5-point Likert
scale where 1=strongly disagree, 2=disagree, 3=neutral, 4=agree and 5=strongly agree. Their responses ranked by the means are shown in Table 5.

Table 5. Barriers of technology to quantity surveying (n=22)

<table>
<thead>
<tr>
<th>Barriers</th>
<th>1 (%)</th>
<th>2 (%)</th>
<th>3 (%)</th>
<th>4 (%)</th>
<th>5 (%)</th>
<th>Mean</th>
<th>SD</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>High cost/extra capital investment</td>
<td>-</td>
<td>14.3</td>
<td>19.0</td>
<td>47.6</td>
<td>19.0</td>
<td>3.71</td>
<td>0.96</td>
<td>1</td>
</tr>
<tr>
<td>Lack of software application interfaces</td>
<td>-</td>
<td>19.0</td>
<td>47.6</td>
<td>19.0</td>
<td>14.3</td>
<td>3.29</td>
<td>0.96</td>
<td>2</td>
</tr>
<tr>
<td>Less familiarity with project</td>
<td>9.5</td>
<td>14.3</td>
<td>23.8</td>
<td>42.9</td>
<td>9.5</td>
<td>3.29</td>
<td>1.15</td>
<td>3</td>
</tr>
<tr>
<td>Software complexity</td>
<td>-</td>
<td>31.8</td>
<td>18.2</td>
<td>40.9</td>
<td>9.1</td>
<td>3.27</td>
<td>1.03</td>
<td>4</td>
</tr>
<tr>
<td>Liability concerns</td>
<td>9.1</td>
<td>18.2</td>
<td>50.0</td>
<td>13.6</td>
<td>9.1</td>
<td>2.95</td>
<td>1.05</td>
<td>5</td>
</tr>
<tr>
<td>Lack of standards</td>
<td>4.5</td>
<td>31.8</td>
<td>36.4</td>
<td>22.7</td>
<td>4.5</td>
<td>2.91</td>
<td>0.97</td>
<td>6</td>
</tr>
<tr>
<td>Threat to services conventionally provided by</td>
<td>13.6</td>
<td>40.9</td>
<td>31.8</td>
<td>9.1</td>
<td>4.5</td>
<td>2.50</td>
<td>1.01</td>
<td>7</td>
</tr>
<tr>
<td>Removed need for a quantity surveyor</td>
<td>36.4</td>
<td>31.8</td>
<td>18.2</td>
<td>9.1</td>
<td>4.5</td>
<td>2.14</td>
<td>1.17</td>
<td>8</td>
</tr>
</tbody>
</table>

From the findings in Table 5 it is evident that respondents tended to agree that the high cost and extra capital investment involved would be the largest barrier to adopting technology by quantity surveyors (mean=3.71). They tended to disagree with the perceptions that technology would remove the need for a quantity surveyor (mean=2.14) or present as a threat to services conventionally provided by quantity surveyors (mean=2.50). They were somewhat neutral about the other barriers (means from 2.91-3.29).

Determinants of technology usage

Respondents were asked to rank the significance of six determinants of the use of technology in quantity practices in ascending order from 1 to 6 with 1 being most significant. The rankings are shown in Table 6.

Table 6. Determinants of technology usage (n=22)

<table>
<thead>
<tr>
<th>Determinants of technology usage</th>
<th>Mean</th>
<th>SD</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Performance expectancy</td>
<td>3.18</td>
<td>1.89</td>
<td>1</td>
</tr>
<tr>
<td>Top management support</td>
<td>3.32</td>
<td>1.67</td>
<td>2</td>
</tr>
<tr>
<td>Effort expectancy</td>
<td>3.45</td>
<td>1.44</td>
<td>3</td>
</tr>
<tr>
<td>Facilitating conditions</td>
<td>4.05</td>
<td>1.21</td>
<td>4</td>
</tr>
<tr>
<td>Social influence</td>
<td>4.09</td>
<td>1.44</td>
<td>5</td>
</tr>
<tr>
<td>Individual resistance to change</td>
<td>4.32</td>
<td>1.78</td>
<td>6</td>
</tr>
</tbody>
</table>

From Table 6 it is evident that respondents regarded the degree to which a particular technology would help individuals attain gains in their employment (Performance expectancy) as the most significant determinant of technology usage in quantity surveying practices. Top management support was the
next most significant determinant. Of the six determinants individual resistance to change was the weakest.

6. CONCLUSIONS

The study found that the knowledge that quantity surveyors had about technology, software and innovation was at best rather average. They recognized the most obvious benefits of embracing technology such as the time taken to produce Bills of Quantities which intuitively they still regard as one of their core services to the construction industry. Similarly, more accurate cost estimation was attractive. Largely because of their lack of knowledge of available technologies they could not comment assertively on many of the issues surrounding the relationship between technology and quantity surveying. They, however, recognized the potential that technology might have on various somewhat routine activities that quantity surveyors get involved with. The greatest inhibitor to technology uptake was the perceived high cost and extra capital needed. They denied that technological advancements presented threats to their existence or the services that they traditionally offered. What would enhance the uptake of technology was the individual gains that could possibly be achieved through mundane and tedious tasks becoming easier and quicker. In the main the findings of the study resonated with those of other studies done particular in developing countries.

7. REFERENCES


Yang, L. 2007. Exploring the links between technology usage and project outcomes, Construction Management and Economics, 25 (10), 1041-1051

An exploratory study of the authenticity of dimension paper as a teaching aid tool

Charles Mothobiso

Faculty of Engineering, Department of Construction Management & Quantity Surveying, Mangosuthu University of Technology, Umlazi, Durban 4026, South Africa. (Tel: +27 31 9077557)
ABSTRACT AND KEYWORDS

Purpose: This study attempts to identify if the current pedagogy of teaching quantity surveying students provides a platform of authentic learning and proper skills transfer as expected by the construction industry. The purpose of this paper is to discover if institutions of higher education are producing quantity surveying students who are ready for the workplace.

Design/methodology/approach: An exploratory study was done using a sample of twelve (12) quantity surveying firms in Durban. Quantitative analysis and presentation of data is used.

Research limitations: The questionnaire was sent to quantity surveying firms in Durban only. The study is exploratory hence it cannot be generalised to the rest of South Africa.

Findings: The findings reveal that the quantity surveying profession has evolved over the years and quantity surveying practices now perceive students to be lacking the technical and soft skills required to run projects. They further find that the use of dimension paper is still relevant as a teaching tool to develop mensuration and quantification skills. Some quantity surveying practices believe that students should have a better understanding of the usage of quantity surveying software for bill production and the cost management of projects. Universities perceive the use of dimension paper as equipping students with logical thinking skills and preparing them to produce bills of quantities.

Response to conference theme: The findings of this paper may assist in the designing of new educational paradigms by guiding institutions in realigning their curriculum to meet the needs of the quantity surveying profession.

Practical implications: The findings enable institutions of higher education to align curriculum to best suit the needs of the quantity surveying profession.

Keywords: Competency, Graduates, Dimension Paper, Education

Conference sub-theme: Construction Education
Introduction

The Quantity Surveying profession has evolved over the years and currently is more problem-solving orientated which means it needs highly competent graduates (Hassan et al., 2011). This evolution of the profession threatens the traditional roles of quantity surveyors (Matzdorf et al., 1997). The evolution of roles is being experienced at all stages of project delivery with design teams facing challenges of new emerging construction materials, technologies and diverse complex project scopes. With all these challenges, quantity surveyors need to have technical, problem-solving and analytical skills to be able to handle and solve site problems (Dada and Musa, 2016). During their years of study, graduate quantity surveyors should have acquired the necessary skills required by the industry, because tertiary institutions are tasked with teaching authentic skills to students (Hassan et al., 2011).

In South African higher education institutions, quantity surveying students are taught a varied range of skills, amongst which are measurement and design appraisal. These skills enable a quantity surveyor to give proper estimates and cost management of construction projects (Nkado and Meyer, 2001). Current technology available to, quantity surveyors allows them to compile bills of quantities (e-BOQ) electronically, using applicable software. However, South African higher education institutions, still insist on teaching quantity surveying students to measure by using manual methods and a dimension paper.

Objectives of Research

The objectives of the research are as follows:

- To find if the current pedagogy of teaching quantity surveying students provides a proper skills transfer and relevance to authentic learning
- To find if graduates have the necessary skills and competency as required by the quantity surveying profession.

Authentic Learning - Psycho-anthropological approaches in Tertiary Students

The fundamental goal in tertiary instruction is to foster in students an ethos of self-regulation, self-motivation and authentic learning (Butler, 1995). In examining the concept of authentic learning in students - be it at secondary or tertiary level - the concept of authenticity must be unpacked using a psycho-educational and philosophical paradigm curve. Essentially, the way the world views the concept of authenticity is directly related to how authenticity is practiced in the teaching-learning process.
Martin Heidegger, a philosopher and metaphysicist, defines authenticity as the act of altering one’s status in society through the determination of action and self-expression. Each person has a Dasein (a unique individual self), and each Dasein takes on a higher purpose from the mundane of human existence when it responds in action to its personal beliefs and vocation. Accompanied by core moral values and integrity, authenticity can lead to a positive alteration of one’s life path (Zimmerman, 1990).

Heidegger’s proposal of Dasein as a Being that is able to inquire, question and reflect on its purpose and existence is vital to the consideration of authenticity. It is only by the creation of an intellect that veers towards learning in an authentic manner that we can determine that authentic learning has taken place in a student at tertiary level.

Heidegger concentrated largely on the fact that a person’s inner authenticity, coming from their personal core beliefs, values and morals are the conditions that make possible all human knowledge and in the process, makes possible action based on the knowledge gained. Heidegger was also a strong advocate of the vocational approach towards teaching: he felt that a student is only learning and practicing authenticity when he/she rejects the advances of industrialisation and begins to implement his/her own personal intellect and skills towards his/her vocation. Heidegger strongly rejected the use of technology and believed that authentic learning could not take place amongst a large environment of instrumentality. He believed that an instrumentalist view of technology had very limited validity, and that a greater level of accuracy and validity was attained using human skill sets as the only resource towards eliciting a vocational goal.

In modern tertiary education it is fast emerging that there is a huge shift from formal, school-type learning towards real-life learning. It has now become a widely accepted phenomenon in the educational sector that authentic learning is far more valuable than didactic teaching/learning methodologies. Harrington and Oliver (2000) argue that authentic learning is situational. They also premise that there is a large divide between knowing and doing. The emphasis in the past has always been on the oftentimes rote extraction of concepts and facts (Blumenfeld, 1987). This method of teaching at secondary or tertiary level is problematic, being too abstract and de-contextualised.

Studies have suggested that much of the abstract knowledge taught at university level is not retrievable in real-life situations with its own problem-solving contextual requirements. Learning has largely become a process-product version of delivery, ignoring the real-life authentic learning of students in real time (Dreyer and Van der Walt, 1996).

This research in no way contends that formal instruction should be completely abandoned in favour of placing students in real-life environments. But, in order for instruction to be situational, producing authentic learning in a technological and vocational-based field, the implication suggests that both a situational as
well as a formal teaching process ensues. This will address authenticity in learning that will be in accordance with Heidegger’s principles of an authentic learner being one that is trained for an authentic life rather than simply a vocation.

It can also be argued that in a technically based field, such as quantity surveying and engineering, the power of a multi-media technological approach has its merits. Reeves (1993) considers that a major benefit of working with the technical aspects of a vocation such as measuring would be a well-designed multi-media environment which would provide students with a simulated environment that would add value to their learning process. In a technology-rich multi-media teaching environment, the constructs of authenticity and situational learning may be taught by allowing the learner to be supported by the technology rather than be governed by it.

South African perspective on the Quantity Surveying Profession

The quantity surveying profession has evolved over the past decades to encompass the duties of project management and facilities management in contrast to the traditional duties of the profession of only the contractual and financial management of projects (Crafford and Smallwood, 2002). The role of a quantity surveyor is defined by Bowen et al., (2010) as a construction economist that works on behalf of the client by giving them advice on designs in order for the project to be executed within budget.

The quantity surveying profession in South Africa is governed by the Act 2000 (49 of 2000). In order to become a Professional Quantity Surveyor one has to enrol for accredited programmes at a university and gain on site practical experience. The candidate’s competency is then later assessed by the South African Council of the Quantity Surveying Profession (SACQSP). The council regulates the registration of professionals and the accreditation of academic programmes. SACQSP accreditation policy allows the council to scrutinise the effectiveness of a programme. The programme should be evaluated by input from advisory boards, industry and employers to ascertain if the intended outcomes and expectations are met (SACQSP policy, 2004). On the other hand the Professional Code of Conduct requires registered individuals to deliver services to clients with due diligence and competence and the standard should be of the required standard as stipulated by the council (SACQSP code of conduct, 2013).

Duties of a Quantity Surveyor

Quantity surveyors must possess technical, problem-solving and analytical skills enabling them to handle and solve on-site problems. Other duties involve taking measurements and working out estimates for the production of Bills of Quantities. Bills of Quantities are defined by Hackett and Robison (2003) as a document laying out the descriptive and quantity elements that are required in a construction project. The traditional use of Bills of Quantities is to provide a cost for the project in order for the clients to do
proper budgeting and for the contractors to price the project during the
tender process (Rashid et al., 2006). The other function of Bills of
Quantities, as explained by Keng and Ching (2011), is as an aid during the
preparation of claims for monthly interim certificates and to help in cost
planning.
Graduate quantity surveyors should be equipped with the necessary skills
expected by the industry. Tertiary institutions are tasked with teaching
authentic skills to students. South African higher education, within the
quantity surveying discipline, teaches students a varied range of skills from
technical through to management, information technology and human skills
(Hassan et al., 2011). Currently quantity surveyors compile electronic bills
of quantities (e-BOQ), using available software. However, education
institutions still only teach quantity surveying students to measure by using
manual methods - a dimension paper (ibid).

Research approach
An exploratory study was done on twelve (12) quantity surveying firms in
Durban. Selection of the firms was done from the database of Association
of South African Quantity Surveyors (ASAQS). The choice of firms was
based on their location and whether they were currently employing and
training graduates. An online set of questionnaires was sent to the
Directors of the firms, all of whom are registered as Professional Quantity
Surveyors (PrQS) by the South African Council for the quantity surveying
profession. The data was analysed and presented quantitatively. The
rationale for the study was to identify the industry expectations and
required knowledge and experience of graduates.

Research Findings
A sample greater than ten (10) firms took part in the exploratory study to
discover the authenticity of dimension paper as a teaching tool as well as to
learn whether graduates from South African higher education institutions
are adequately prepared for the work place. The majority of employers
prefer to recruit graduates that possess Bachelor of Technology degrees,
followed by National Diploma and Bachelor of Science degrees. The least
recruited are students with Bachelor of Science (Honours) Degrees. The
data may be influenced by the fact that the University that has been
offering the Honours degree in the region has not had any graduates of
quantity surveying for three (3) years. Even though the data reveals that
the majority of students recruited hold a Bachelor of Technology degree, it
is also shown that employers prefer to recruit Bachelor of Science students.
It would also appear that employers prefer to recruit junior quantity
surveyors who hold a Bachelor of Science degree.
All of the participating firms have a proper mentorship programme which develops and helps graduates towards attaining professional registration. Another reason that might influence the preference of employers on the qualification is the ease with which the graduate gets professional status. This is because the graduates with Bachelor of Technology and non-accredited courses tend to register again for additional modules offered by the council in order for them to be deemed ready for the council examination. Most employers take graduates as Trainee Quantity Surveyors or Candidate Quantity Surveyors and seventy three percent (73%) of employers employ these graduates as permanent employees. Most of the companies have employed at least one (1) graduate. Some firms have put up to five (5) graduates through candidacy training.

About fifty percent (50%) of the participants felt that the graduates’ educational qualifications prepared them for the position. About forty one percent (41%) agree with the statement that the graduates were ready for the workplace when they graduated. This still shows a 50-50 situation that the industry is not fully confident with the graduates’ readiness for the workplace.

About forty two percent (42%) of the participants believe that graduates are not prepared for the workplace with the same proportion believing that the
students are prepared. A similar trend of indecisiveness is noticed meaning there is still no clear indication whether students are really ready and prepared for the workplace or not. Despite this situation, it was noticed that most firms provide additional training to graduates in the first year to enhance their skills and improve their ability to perform in the workplace.

Most firms require graduates to have sufficient information technology skills to perform in the workplace. It is noticed that the majority of firms - about seventy five percent (75%) - have adopted the use of Win-QS as their software to produce and manage quantification. Even though firms mainly use software to produce bills of quantities they do sometimes use dimension paper for quantifying.

<table>
<thead>
<tr>
<th>How often the firm uses Dim-paper</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very often</td>
<td>16.67%</td>
</tr>
<tr>
<td>Often</td>
<td>16.67%</td>
</tr>
<tr>
<td>Sometimes</td>
<td>50.00%</td>
</tr>
<tr>
<td>Never</td>
<td>16.67%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

Table 1: The use of Dimension paper by quantity surveying firms

The data reveals that the majority of firms sometimes use dimension paper. About thirty three percent (33%) of the firms use dimension paper often. There is a proportion of seventy percent (70%) of firms that never use dimension paper. These are the firms that have probably fully adopted the use of software to produce bills of quantities. Despite technological advancement fifty percent (50%) of the participants still feel that the use of a dimension paper is still relevant in the daily duties of a quantity surveyor. Only thirty three percent (33%) of the participants disagree.

Noting the perceived importance of dimension paper, about eighty three percent (83%) of the participants believe that institutions of higher learning should continue teaching students in the use of dimension paper. On the other hand seventeen percent (17%) believe that exposure to an electronic form of measurement should be more emphasised as graduates pick it up very quickly. Some participants feel that the use of dimension paper is still essential in formulating a mental system of measurement and theory behind quantification and that in some respects it is quicker and easier to trace information and amend it by using dimension paper.
Graduates capability and competency levels
The quantity surveying profession is ranked in the top ten (10) as being a critical skill by the Ministry of Home Affairs. This means that the country is in short supply of professionally qualified and skilled quantity surveyors. Despite this shortage, it seems the industry is not fully satisfied with the quality of graduates it gets from the institutions of higher learning. It is evident from the graph below that the industry finds graduates lacking the practical experience that is expected of them. University of Technology students are often given an opportunity to gain practical experience as compared to traditional universities. However, in general, they are perceived to lack this experience. The other low ranking competency is that graduates lack prior knowledge as to how quantity surveying firms operate. This indicates that graduates do not understand the basic function of quantity surveying as a business on a daily basis.

![Figure 3: Skills and competencies of Quantity Surveyors]

It appears that the graduates lack technical writing skills which they need to produce technical and operational reports; this is evident from the low ranking of this skill. The industry also perceives that the graduates lack an understanding of productivity. However, the industry seems to be happy with the graduates’ personal attitudes and cooperation when they join a company. This means that graduates are willing to learn.

There seems to be a lack of confidence at graduate level in terms of leadership assignments. This could be related to their lack of practical experience which may prevent them from taking on a leadership role. The students seem to be moderately equipped with computer skills, arithmetical and analytical skills. These skills are very important for a quantity surveyor because they deal with quantification and arithmetic most of the time.
Conclusions

The study reveals that graduates are expected to be taught authentic skills while they are still at institutions of higher learning. This enables them to cope with real practical issues when they join the workplace. Consequently, having this practical experience boosts graduates’ morale and confidence and in turn enables them to execute leadership roles in quantity surveying practices.

The use of dimension paper is slowly disappearing with technology dominating the production of bills of quantities. The industry feels that there is a need to continue teaching students on how to use dimension paper as it is perceived to enable students to better understand the technique of mensuration.

The industry is not fully confident about graduate skills and competencies. There seems to be identifiable gaps that need to be addressed by institutions of higher learning especially in the areas of practical exposure during learning, technical writing skills and an understanding of the work environment and how quantity surveying practices are run. Despite the low levels in other skills areas the graduates tend to score fairly moderately in areas of productivity, professional ethics and oral communication. Graduates are also perceived to have a positive attitude towards learning and developing.

References:


Code of Professional Conduct, Published in terms of the Quantity Surveying Profession Act 2000 (49 of 2000), Revised March 2003


Core entrepreneurial competencies for civil engineers to be successful professionals

Theo C. Haupt¹ and Jan van der Westhuizen²
Haupt@ukzn.ac.za ¹ and jan@mut.ac.za ²

¹ Professor, Construction Studies Program, University of KwaZulu-Natal, Howard College, Durban 4001, South Africa. (Tel: +27 31 2602712)

² Faculty of Engineering, Department of Civil Engineering, Mangosuthu University of Technology, Umlazi, Durban 4026, South Africa. (Tel: +27 31 9077232)

ABSTRACT AND KEYWORDS

Purpose: Since entrepreneurship is viewed as a path to sustainable economic development, this study examines the managerial and entrepreneurial competencies necessary for entrepreneurial action.

Design/methodology/approach: A sample of 24 civil engineers was surveyed to determine the relative importance of 13 core entrepreneurial competencies to be successful as professionals.

Research limitations: The sample of 24 civil engineers was drawn from the Durban area in KwaZulu-Natal province from a South African Institute of Civil Engineers database.

Findings: Preliminary findings suggest that there are competencies that are unique to the civil engineering discipline and that education programs need to construct curriculums that support the entrepreneurial endeavours of graduates.

Response to conference theme: This study identifies those competencies that are necessary for civil engineers to be successful as professionals, an aspect of their education and training that has been ignored.
**Practical implications:** The findings provide guidance for the development of curriculums that are responsive to the development of these core competencies in civil engineering graduates.

**Keywords:** Entrepreneurship, civil engineering, competencies

**Conference sub-theme:** Construction Education

1. **INTRODUCTION**

South Africa and most probably all of the Sub-Saharan countries are subjected to adverse poverty. To exacerbate the problem the unemployment and underemployment of graduates has become an international issue (Morshidi, Bakar, Lim & Mohammed, 2004). Efe (2014) described entrepreneurship education as a panacea for unemployment and poverty eradication for national security. The term “entrepreneurship" became an everyday buzzword, either in a macro context or in an individual context. In macro context it is believed to be an enabler of economy growth and development. Sondari (2014) stated that entrepreneurship activities are believed to be a tool to boost economy growth and to solve other economic problems such as unemployment. Given the increasing number of graduates who struggle to find employment post-university, entrepreneurship presents opportunities.

According to Lambropoulosa, et al. (2014) the recent global economic and financial crisis has led many countries into recession, which caused these countries to reduce both their public investment in infrastructure and private investment in buildings. As a result, the unemployment is particularly evident in the civil engineering and building sectors.

As a result there should be an increase in the delivery of entrepreneurship education to engineering students through new courses, programmes and experiential learning opportunities. According to Wahed, et al. (2013), entrepreneurship education in engineering and technology is lacking in the majority of Universities worldwide.

2. **CORE ENTREPRENEURIAL COMPETENCIES**

A competency refers to the knowledge, skills, attitudes, values and behaviours that people need to successfully perform a particular activity or task (Brophy & Kiely, 2002). Thirteen competencies that are core to the entrepreneurship discipline were identified by Morris, et al., (2013) in a major Delphi study. These competencies can be enhanced through exposure to a structured entrepreneurship education program designed and taught at university. A desirable outcome of such a program should be
the transformation of students into successful entrepreneurs that possess these core entrepreneurial competencies. Therefore, one of the key objectives of entrepreneurship education should be the creation of general awareness of what entrepreneurship actually entails.

Entrepreneurial competence

Morris, et al. (2013) indicated that entrepreneurship is viewed as a process that unfolds as individuals perform within and interact with their environments. Environments provide scripts that guide individual behaviours and interactions and education serves as an important source of scripts within the individual’s environment. When placed in the context that centres on experiencing and performing real tasks that support entrepreneurial outcomes respondents may appear to demonstrate some competencies (Morris, et al., 2013). Only when entrepreneurship is seen as a unique and desirable discipline will the necessary competence be sought after and evident in graduates. The acquisition of entrepreneurial competence by students will result in new organizations and enterprises with them being responsible for deciding the structure of these entities and the allocation and sourcing of resources. Arguably, without entrepreneurial competence the opportunity will be missed for solving economic demands that lead to sustainable economic development (Birch, 1987).

Adequacy of university preparation

Entrepreneurial education is the process of providing individuals with the ability to recognize commercial opportunities and the insight, self-esteem, knowledge and skills to act on them. It includes instruction in opportunity recognition, commercialization of a product or service, securing resources in the face of risk, and initiating a business venture (Jones and English, 2004). It is argued that entrepreneurial education has to be a structured formal intervention designed by higher education institutions. There is a positive correlation between entrepreneurship education and the number of graduates who eventually become entrepreneurs instead of job-seekers. Arguably, in the absence of entrepreneurship education graduates from university will be poorly prepared for the real world of work and professional practice. Entrepreneurship education can lead to increased entrepreneurial intentions of students (Morris, et al., 2013).

The 13 core competencies that were identified by Morris, et al. (2013) could be integrated into the curriculum for entrepreneurship education to develop these specific competencies in students. These unique competencies can assist the content of entrepreneurship education programs going forward. Research evidence suggests that entrepreneurship education can produce a range of desired outcomes from
increased entrepreneurial intentions to students becoming self-employed (Dickson, et al., 2008).

Knowledge of entrepreneurship

According to Neck and Greene (2011), entrepreneurship is a domain of traits that can be learned and therefore can be taught. The new generation of engineers need not only to have a deep knowledge of the field of study but also several other skills. It has been argued that these additional skills can be developed through entrepreneurship education (Täks, et al., 2014). Duval-Couetil, et al. (2016) stated that it is necessary to explore the characteristics of entrepreneurship programme models that are most effective for engineering students in order to provide the engineering faculty and programme administrators with features to consider when developing entrepreneurship programmes targeting engineering students. Research that examines how several aspects of entrepreneurship programs, including disciplinary focus, participation in experiential learning, and number of courses, impact student perceptions of their entrepreneurial knowledge and self-efficacy.

Entrepreneurial tasks

Understanding the activities of entrepreneurs, that is, what they actually do, when they start a venture is “perhaps the most under-researched aspect of the individual and venture creation” (Shook et al., 2003:390). The range of these activities is typically large. The attention and time given to these many and varied activities has to be balanced to ensure that they devote enough resources to key tasks (Baron, 2007). Of necessity entrepreneurs have to be involved in all aspects of the business, especially in the early stages of a new venture when they often are the business. These activities include strategic tasks, for example finding the idea, evaluating different options, constructing a business plan, choosing investors and key staff, and operational tasks like running a marketing campaign, keeping financial accounts, project managing the business, creating invoices, chasing up payments. Other important entrepreneurial tasks that will need to done include, for example, estimating accurately the costs of running a new project, recruiting the right employees for a new project or venture, working with a supplier to get better prices to help a venture become successful, writing a clear and complete business plan and picking the right marketing approach for the introduction of a new service.

In the early stages of a venture, when the entrepreneur takes on these many and varied roles, the success of the venture can depend on the entrepreneur’s ability to find a balance between different tasks. Spending too much time on, for example, constructing a comprehensive and
professional business plan can come at the expense of marketing activities to raise the profile of the business with potential customers.

To date, few researchers have examined to what extent different programme models and experiential activities impact respondent’s perceptions of their entrepreneurial knowledge, skills, and self-efficacy. Findings indicate that higher perceptions of entrepreneurial knowledge were associated with the number of entrepreneurship courses taken and involvement in experiential learning activities (Duval-Couetil, et al., 2016).

3. RESEARCH APPROACH

A convenience sample was surveyed comprising of 24 civil engineers practicing in the Kwazulu-Natal province of South Africa about their views on core entrepreneurial competencies to be successful professionals. The data was collected via a quantitative questionnaire survey comprising of several sections, namely a section containing 13 core entrepreneurial competencies, a section containing 14 aspects of entrepreneurial competence, a section containing 7 statements about university preparation of civil engineers for entrepreneurship, a section containing 37 entrepreneurship knowledge areas, and a final section containing 15 entrepreneurial tasks to which respondents were required to give a scaled response of agreement. Descriptive statistics were derived using SPSS v23 and presented including measures of central tendency and dispersion. The internal validity of scaled responses was determined by the Cronbach’s alpha co-efficient for validity.

4. RESEARCH FINDINGS

Profile of Respondents

Most respondents had practiced as civil engineers for a median 12 years. Almost all the respondents (95.5%) were male. About one-quarter (27.3%) of respondents had their own practices while 66.7% had considered setting up their own practices.

Reliability

The Cronbach’s alpha co-efficients for the various scaled responses indicate acceptable degrees of internal consistency for the all scales used, namely a Cronbach Alpha statistic which is greater than the rule-of-thumb 0.70 for acceptable internal scale consistency. There is therefore between 69.8% and 97.5% probability that the constructs each measured a single
underlying concept with an error of at most 5%. The scale used is therefore acceptable in measuring of the reliability of the constructs.

Table 1. Reliability co-efficients (n=24)

<table>
<thead>
<tr>
<th>Construct</th>
<th>Reliability co-efficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Core entrepreneurial competencies</td>
<td>0.838</td>
</tr>
<tr>
<td>Entrepreneurial competence</td>
<td>0.698</td>
</tr>
<tr>
<td>University preparation</td>
<td>0.891</td>
</tr>
<tr>
<td>Entrepreneurial knowledge</td>
<td>0.975</td>
</tr>
<tr>
<td>Entrepreneurial tasks</td>
<td>0.931</td>
</tr>
</tbody>
</table>

**Core entrepreneurial competencies**

Respondents were presented with a list of 13 core entrepreneurial competencies and required to indicate using a 5-point Likert scale the importance of each to being a successful professional civil engineer. Their responses ranked by the means are shown in Table 2.

Table 2. Core entrepreneurial competencies (n=24)

<table>
<thead>
<tr>
<th>Entrepreneurial competence</th>
<th>Mean</th>
<th>Std Dev</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Risk Management/Mitigation: the taking of actions that reduce the probability of a risk occurring or reduce the potential impact if the risk were to occur</td>
<td>4.46</td>
<td>0.72</td>
<td>1</td>
</tr>
<tr>
<td>Creative problem solving/imaginativeness: the ability to relate previously unrelated objects or variables to produce novel and appropriate or useful outcomes</td>
<td>4.42</td>
<td>0.65</td>
<td>2</td>
</tr>
<tr>
<td>Self-efficacy: ability to maintain a sense of self-confidence regarding one’s ability to accomplish a particular task or attain a level of performance</td>
<td>4.38</td>
<td>0.82</td>
<td>3</td>
</tr>
<tr>
<td>Value creation: capabilities of developing new products, services, and/or business models that generate revenues exceeding their costs and produce sufficient user benefits to bring about a fair return</td>
<td>4.38</td>
<td>0.87</td>
<td>4</td>
</tr>
<tr>
<td>Building and using networks: social interaction skills that enable an individual to establish, develop, and maintain sets of relationships with others who assist them in advancing their work or career</td>
<td>4.29</td>
<td>0.69</td>
<td>5</td>
</tr>
<tr>
<td>Opportunity Recognition: the capacity to perceive changed conditions or overlooked possibilities in the environment that represent potential sources of profit or return to a venture</td>
<td>4.26</td>
<td>0.81</td>
<td>6</td>
</tr>
<tr>
<td>Opportunity Assessment: ability to evaluate the</td>
<td>4.22</td>
<td>0.67</td>
<td>7</td>
</tr>
</tbody>
</table>
Respondents reported in Table 2 that 11 of the 13 core entrepreneurial competencies were important to very important with means ranging from 4.00 to 4.46 to be successful as a professional civil engineer. They regarded as most important risk management or mitigation which is the taking of actions that reduce the probability of a risk occurring or reduce the potential impact if the risk were to occur (mean=4.46), creative problem solving or imaginativeness which is the ability to relate previously unrelated objects or variables to produce novel and appropriate or useful outcomes (mean=4.42), self-efficacy which is the ability to maintain a sense of self-confidence regarding one's ability to accomplish a particular task or attain a level of performance (mean=3.38) and value creation which is the capability to develop new products, services, and/or business models that generate revenues exceeding their costs and produce sufficient user benefits to bring about a fair return (mean=3.38). They regarded as least important of the 13 competencies resource leveraging which is the skill needed to access resources one does not necessarily own or control to accomplish personal ends (mean=3.54).
Entrepreneurial competence

Respondents were presented with 14 statements about their levels of entrepreneurial competence and required to indicate using a 5-point Likert scale the extent to which they agreed with each of the statements. Their responses ranked by the means are shown in Table 3.

Table 3. Levels of entrepreneurial competence (n=24)

<table>
<thead>
<tr>
<th>Entrepreneurial competence</th>
<th>Mean</th>
<th>Std Dev</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>I believe that I can grow in positive ways by dealing with difficult situations</td>
<td>4.46</td>
<td>0.72</td>
<td>1</td>
</tr>
<tr>
<td>I can shape whatever environment in which I find myself operating</td>
<td>4.04</td>
<td>0.95</td>
<td>2</td>
</tr>
<tr>
<td>I can distinguish between profitable opportunities and not so profitable opportunities</td>
<td>3.92</td>
<td>0.93</td>
<td>3</td>
</tr>
<tr>
<td>I am creative when asked to work with limited resources</td>
<td>3.92</td>
<td>0.93</td>
<td>3</td>
</tr>
<tr>
<td>When facing multiple opportunities I am able to select the good ones</td>
<td>3.86</td>
<td>0.71</td>
<td>5</td>
</tr>
<tr>
<td>New business ideas often come to me when directly observing how people interact with products and services</td>
<td>3.75</td>
<td>0.99</td>
<td>6</td>
</tr>
<tr>
<td>I often make novel connections and perceive new relationships between various pieces of information</td>
<td>3.67</td>
<td>0.92</td>
<td>7</td>
</tr>
<tr>
<td>There is always a way to obtain a resource even if you cannot afford it</td>
<td>3.67</td>
<td>0.92</td>
<td>7</td>
</tr>
<tr>
<td>I could quickly identify three guerrilla ideas to help a start-up venture</td>
<td>3.67</td>
<td>1.01</td>
<td>9</td>
</tr>
<tr>
<td>I tend to look for the right answer, rather than realize there might be multiple ways to get to an end result</td>
<td>3.50</td>
<td>0.93</td>
<td>10</td>
</tr>
<tr>
<td>I often attend social functions for purposes of building professional relationships</td>
<td>3.46</td>
<td>1.02</td>
<td>11</td>
</tr>
<tr>
<td>I am more of a risk avoider than a risk manager</td>
<td>3.29</td>
<td>1.08</td>
<td>12</td>
</tr>
<tr>
<td>I find it difficult to get others committed to my vision or dreams</td>
<td>2.83</td>
<td>0.94</td>
<td>13</td>
</tr>
<tr>
<td>I often set a goal but later choose to pursue a different one</td>
<td>2.38</td>
<td>1.24</td>
<td>14</td>
</tr>
</tbody>
</table>

Respondents agreed most strongly that they could grow in positive ways by dealing with difficult situations (mean=4.46). They agreed that they could shape whatever environment they found themselves operating in (mean=4.04). They tended to disagree that they often set goals but chose later to pursue different ones (mean=2.38). They also disagreed that they
found it difficult to get others committed to their vision or dreams (mean=2.83).

**Adequacy of university preparation**

Respondents were presented with seven statements about their university experience of preparation for being entrepreneurs and asked to indicate on a 5-point Likert scale to what extent they agreed with the statements. Their responses ranked by the means are shown in Table 4.

<table>
<thead>
<tr>
<th>Statement</th>
<th>Mean</th>
<th>Std Dev</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>The University modules/offerings/classes I attended enhanced my practical management skills in order to start a business</td>
<td>2.79</td>
<td>1.18</td>
<td>1</td>
</tr>
<tr>
<td>The University modules/offerings/classes I attended increased my understanding of the attitudes, values and motivations of entrepreneurs</td>
<td>2.71</td>
<td>1.27</td>
<td>2</td>
</tr>
<tr>
<td>At my university I found many entrepreneurial-minded classmates</td>
<td>2.67</td>
<td>1.01</td>
<td>3</td>
</tr>
<tr>
<td>The University modules/offerings/classes I attended enhanced my ability to identify an opportunity</td>
<td>2.67</td>
<td>1.13</td>
<td>4</td>
</tr>
<tr>
<td>The University modules/offerings/classes I attended enhanced my ability to develop networks</td>
<td>2.58</td>
<td>1.06</td>
<td>5</td>
</tr>
<tr>
<td>The University modules/offerings/classes I attended increased my understanding of the actions someone has to take in order to start a business</td>
<td>2.46</td>
<td>1.10</td>
<td>6</td>
</tr>
<tr>
<td>There was a favourable climate and premises for becoming an entrepreneur at my university</td>
<td>2.17</td>
<td>1.17</td>
<td>7</td>
</tr>
</tbody>
</table>

Respondents tended to disagree with all the statements about the role of their universities in preparing them to be civil engineering entrepreneurs with means ranging from 2.79 to 2.17. They disagreed least that university modules, offerings and classes that they attended enhanced their practical management skills to start a business (mean=2.79). They disagreed most strongly that there had been a favourable climate and premises for becoming entrepreneur at their universities (mean=2.17).

**Knowledge of entrepreneurship**

Respondents were presented with 37 entrepreneurship knowledge areas and topics and requested on a 5-point Likert scale to indicate their level of
knowledge of each of the areas and topics. Their responses ranked by the means are shown in Table 5.

<table>
<thead>
<tr>
<th>Topic</th>
<th>Mean</th>
<th>Std Dev</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Managing teams</td>
<td>4.21</td>
<td>0.78</td>
<td>1</td>
</tr>
<tr>
<td>Leadership</td>
<td>4.17</td>
<td>0.56</td>
<td>2</td>
</tr>
<tr>
<td>Project management</td>
<td>4.08</td>
<td>0.65</td>
<td>3</td>
</tr>
<tr>
<td>Business ethics</td>
<td>4.00</td>
<td>0.93</td>
<td>4</td>
</tr>
<tr>
<td>Negotiation</td>
<td>4.00</td>
<td>0.98</td>
<td>5</td>
</tr>
<tr>
<td>Role of entrepreneurs in the world economy</td>
<td>3.88</td>
<td>0.99</td>
<td>6</td>
</tr>
<tr>
<td>Feasibility study</td>
<td>3.63</td>
<td>1.17</td>
<td>7</td>
</tr>
<tr>
<td>Risk management</td>
<td>3.58</td>
<td>1.02</td>
<td>8</td>
</tr>
<tr>
<td>Characteristics of entrepreneurs</td>
<td>3.54</td>
<td>1.02</td>
<td>9</td>
</tr>
<tr>
<td>Product development</td>
<td>3.54</td>
<td>1.10</td>
<td>10</td>
</tr>
<tr>
<td>Intellectual property</td>
<td>3.50</td>
<td>1.18</td>
<td>11</td>
</tr>
<tr>
<td>Target market</td>
<td>3.50</td>
<td>1.35</td>
<td>12</td>
</tr>
<tr>
<td>Income statement</td>
<td>3.48</td>
<td>1.20</td>
<td>13</td>
</tr>
<tr>
<td>Business plan</td>
<td>3.46</td>
<td>0.98</td>
<td>14</td>
</tr>
<tr>
<td>Market research</td>
<td>3.42</td>
<td>1.35</td>
<td>15</td>
</tr>
<tr>
<td>Advertising and promotion</td>
<td>3.38</td>
<td>1.21</td>
<td>16</td>
</tr>
<tr>
<td>Product lifecycle</td>
<td>3.29</td>
<td>1.00</td>
<td>17</td>
</tr>
<tr>
<td>Executive summary</td>
<td>3.29</td>
<td>1.16</td>
<td>18</td>
</tr>
<tr>
<td>Equity</td>
<td>3.25</td>
<td>1.26</td>
<td>19</td>
</tr>
<tr>
<td>Social entrepreneurship</td>
<td>3.17</td>
<td>1.03</td>
<td>20</td>
</tr>
<tr>
<td>Intrapreneurship</td>
<td>3.17</td>
<td>1.15</td>
<td>21</td>
</tr>
<tr>
<td>Economies of scale</td>
<td>3.13</td>
<td>1.22</td>
<td>22</td>
</tr>
<tr>
<td>Sales and selling</td>
<td>3.13</td>
<td>1.23</td>
<td>23</td>
</tr>
<tr>
<td>Patents</td>
<td>3.13</td>
<td>1.26</td>
<td>24</td>
</tr>
<tr>
<td>Competitive analysis</td>
<td>3.09</td>
<td>1.41</td>
<td>25</td>
</tr>
<tr>
<td>Break even</td>
<td>3.05</td>
<td>1.25</td>
<td>26</td>
</tr>
<tr>
<td>Finance and accounting</td>
<td>3.04</td>
<td>1.23</td>
<td>27</td>
</tr>
<tr>
<td>Prototype</td>
<td>3.04</td>
<td>1.27</td>
<td>28</td>
</tr>
<tr>
<td>Balance sheet</td>
<td>3.04</td>
<td>1.33</td>
<td>29</td>
</tr>
<tr>
<td>Legal structures for ventures (forms of business entities)</td>
<td>3.00</td>
<td>0.98</td>
<td>30</td>
</tr>
<tr>
<td>Technology commercialization</td>
<td>3.00</td>
<td>1.10</td>
<td>31</td>
</tr>
<tr>
<td>Business models</td>
<td>3.00</td>
<td>1.10</td>
<td>31</td>
</tr>
<tr>
<td>Company valuation</td>
<td>2.96</td>
<td>1.20</td>
<td>33</td>
</tr>
<tr>
<td>Product distribution</td>
<td>2.88</td>
<td>1.23</td>
<td>34</td>
</tr>
<tr>
<td>Product positioning</td>
<td>2.74</td>
<td>1.32</td>
<td>35</td>
</tr>
<tr>
<td>Venture capital</td>
<td>2.63</td>
<td>1.05</td>
<td>36</td>
</tr>
<tr>
<td>Business incubator</td>
<td>2.27</td>
<td>1.08</td>
<td>37</td>
</tr>
</tbody>
</table>
From Table 5 it is evident that respondents had most knowledge about managing teams (mean=4.21) and leadership skills (mean = 4.17). They tended to have some knowledge about the role of entrepreneurs (mean = 3.88) and their characteristics (mean = 3.54), but their knowledge of running their own businesses diminished with a mean of 2.63 for venture capital.

**Entrepreneurial tasks**

Respondents were presented with 15 entrepreneurship tasks and requested on a 5-point Likert scale to indicate their level of confidence to perform each of the tasks. Their responses ranked by the means are shown in Table 6.

Table 6. Ability to perform entrepreneurial tasks (n=24)

<table>
<thead>
<tr>
<th>Entrepreneurial task</th>
<th>Mean</th>
<th>Std Dev</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Estimate accurately the costs of running a new project</td>
<td>4.09</td>
<td>0.92</td>
<td>1</td>
</tr>
<tr>
<td>Design and build something new that performs very close to your design specifications</td>
<td>3.76</td>
<td>1.14</td>
<td>2</td>
</tr>
<tr>
<td>Translate user needs into requirements for a design so well that users will like the outcome</td>
<td>3.76</td>
<td>1.09</td>
<td>3</td>
</tr>
<tr>
<td>Lead a technical team developing a new product to a successful result</td>
<td>3.71</td>
<td>0.96</td>
<td>4</td>
</tr>
<tr>
<td>Recruit the right employees for a new project or venture</td>
<td>3.55</td>
<td>1.10</td>
<td>5</td>
</tr>
<tr>
<td>Grasp the concept and limits of a technology well enough to see the best ways to use it</td>
<td>3.50</td>
<td>1.01</td>
<td>6</td>
</tr>
<tr>
<td>Recognize when an idea is good enough to support a major business venture</td>
<td>3.50</td>
<td>1.14</td>
<td>7</td>
</tr>
<tr>
<td>Work with a supplier to get better prices to help a venture become successful</td>
<td>3.45</td>
<td>1.14</td>
<td>8</td>
</tr>
<tr>
<td>Understand exactly what is new and important in a ground-breaking theoretical article</td>
<td>3.43</td>
<td>0.98</td>
<td>9</td>
</tr>
<tr>
<td>Convert a useful scientific advance into a practical application</td>
<td>3.41</td>
<td>1.14</td>
<td>10</td>
</tr>
<tr>
<td>Convince a customer or client to try a new product for the first time</td>
<td>3.09</td>
<td>0.97</td>
<td>11</td>
</tr>
<tr>
<td>Write a clear and complete business plan</td>
<td>3.09</td>
<td>1.06</td>
<td>12</td>
</tr>
<tr>
<td>Pick the right marketing approach for the introduction of a new service</td>
<td>3.00</td>
<td>1.02</td>
<td>13</td>
</tr>
<tr>
<td>Develop your own original hypothesis and a research plan to test it</td>
<td>3.00</td>
<td>1.23</td>
<td>14</td>
</tr>
<tr>
<td>Know the steps needed to place a financial value on a new business venture</td>
<td>2.91</td>
<td>1.15</td>
<td>15</td>
</tr>
</tbody>
</table>
From Table 6 it is evident that respondents were the most confident about estimating accurately the costs of running a new project (mean=4.09). They tended to be confident about designing and building something new that performed very close to their design specifications (mean=3.76) and translating user needs so well into requirements for a design that users would like the outcome (mean=3.76) and leading a technical team to develop a new product to a successful result (mean=3.71). They were least confident about the steps needed to place a financial value on a new business venture (mean=2.91).

5. CONCLUSION

In summing up the results of this study, the main findings are presented in the light of the research instruments that were used.

Civil engineers:
- Understand that the 13 core entrepreneurial competencies are important to be successful professionally;
- Understand the importance to work under difficult situations to pursue their dreams and visions;
- Are convinced that the universities they attended did not play a major role to interest them in entrepreneurship;
- Understand how to manage teams with their leadership skills; and
- Are confident to estimate costs, design and build new structures.

However, it is clear from these findings that civil engineers lacked the basic skills to run their own businesses and therefore further studies are needed to identify those unique competencies necessary for civil engineers to be successful as professionals. As a result civil engineering discipline education programmes need to develop curricula that support the entrepreneurial endeavours of civil engineering graduates, an aspect of their education and training that has to date been ignored.

6. REFERENCES


Extracurricular activity predicting mathematics performance

Justus N. Agumba¹; Theo Haupt²

¹Department of Construction Management and Quantity Surveying, University of Johannesburg corner Siemert and Beit Streets, Doornfontein, 2028, Johannesburg, South Africa, jagumba@uj.ac.za, Tel No. +27 11 559 6488
²Construction Studies Program, University of KwaZulu-Natal, Durban, South Africa pinnacle.haupt@gmail.com

ABSTRACT

Purpose of this paper
This paper focuses on evaluating the extracurricular activities undertaken by civil and built environment students at a comprehensive university in South Africa and their influence in mathematics success.

Methodology
Data was obtained through, questionnaire survey from 197 students purposively sampled. The data was analysed using statistical package for the social sciences (SPSS) version 22. Mean value was used to determine the frequently practiced extracurricular activities by the students. Binary logistic regression analysis determined if the frequency of participating in a particular extracurricular activity influenced mathematics success.

Findings
The study found that students spending time in the residence chatting with friends was ranked 1st. However, the mean score was 2.31 in the band 1.81 to 2.60. It can be suggested that students pursuing civil and built environment courses rarely or were not participating in extracurricular activities. However, when modelling extracurricular activity participation with mathematics success. Those who rarely participated in employment off campus for payment were likely to pass mathematics at their first attempt than those who never participated in off campus employment for payment.

Limitation
The study was undertaken in one institution. Further, only two departments were surveyed out of the 13 in the faculty of engineering in this institution. Hence, the findings cannot be generalized across South Africa.
Value
This study informs the university management to encourage its student body to promote students participation in extracurricular activities. However, despite the rarity of students’ participation on off campus employment for payment predicted their mathematics success. This finding should be cautiously implemented as it might negatively affect students’ performance if not addressed properly in any tertiary institution.

Keywords: Binary, Built Environment, Extracurricular activities, University.

1. INTRODUCTION

Education success is typically measured by higher achievement in examinations. It can further be indicated that, the quality of education improves the quality of human resources and is directly related to increased individual earnings and productivity, and economic growth. However, the benefits of education in the engineering and built environment courses might not be fully realized by students as they perform poorly in mathematics which is a subject taught in most of these courses. Furthermore, several media reports i.e. in newspapers; television and radio have indicated that South Africa has the worst mathematics and science education in the world.

According to the World Forum Economic report (2015), it indicated that South Africa was ranked last of the 143 countries surveyed on the quality of mathematics and science education. The mean value was 1.9 in a 7 point Likert scale. This value is an indicator that the quality of mathematics and science education was somewhat extremely poor. On the quality of its education system South Africa was ranked 139 out of 143 countries surveyed. The mean value was 2.2 in a 7 point Likert scale. The mean value indicated that the quality of education system was tilting towards not well. This current report supports MacGregor (2009) news article, which indicated that vice-chancellors warned the South African government to expect more student drop out, following shocking results of pilot national benchmarking tests (NBT). They further indicated that higher education institutions face greater challenges in relation to mathematics. The NBT revealed that only 7% of students were found to be proficient, therefore ready to study first year mathematics.

The Alternative Admissions Research Project (2009) found that majority of students would find it difficult to pass mathematics at university level without additional support (Dennis and Murray, 2012). In line with this sentiment it can be suggested that college life can be stressful, although it is undoubtedly one of the most memorable experiences in one’s life. It represents a critical developmental period for both late adolescents and young adults (Chickering, 1969). Students’ academic performance has attracted the attention of academic researchers from different fields. They have tried to determine variables that impact student performance in
positive and negative direction. Determining the factors that affect student academic performance or success is important, because primarily, institutions and lecturers have to find ways to increase student achievement.

Student success or performance can be influenced by many factors; among them are; involvement in activities out of the classroom, their socio-economic background, pre-college academic achievement and performance after graduation from college (Kuh, Cruce, Shoup, Kinzie, and Gonyea, 2008). However, the relationship between extracurricular activities and academic achievement of college students is a topic open to denunciation.

Seminal research study on extracurricular activities have linked its engagement to low academic performance (Mehus, 1932), other studies support the positive effect of extracurricular activities on student performance (Kuh et al., 2008; Hattie, 2008). However, other studies found that not all activities out of classroom settings are beneficial to student success; some enhance performance, whereas others are obstruction from academic work (Mehus, 1934; Broh, 2002, and Baker 2008).

Despite the different views stated. This study purports that the frequency of participating in extra-curricular activity predicts academic success, which can also be viewed to predict mathematics success for civil engineering and built environment students. Several ground-breaking studies on extra-curricular activities (Astin, 1985; Tinto, 1993; Pascarella and Terenzini, 2005; Hattie, 2008) suggest that there is a positive correlation between student engagement and student learning and persistence. Astin theorized that student learning is a function of a student’s level of academic and social involvement with the institutional environment, whereas Tinto posited that the extent to which students share the values and norms of other individuals in the institution impacts their persistence in college.

It is envisaged that the findings of this study may be applicable to related courses (those that require the application of mathematics knowledge) especially with high failure rates.

2. LITERATURE REVIEW

The extracurricular activities designed by the universities facilitate students to experience authentic learning by constructing their own thoughts and applying their ideas. However, like other development initiatives, outcomes of extracurricular activities depend on student’s ability to explore and make use of the concepts they have learned. Therefore, the involvement in a program can be emphasized in two elements, what the student does, and what the institution does, pointing to activities on the part of the individual student and the institution which are related to the desired outcomes of universities (Wolf-Wendel, Ward and Kinzie, 2009). It has been established
that physical programs i.e. involving the movement of the body regulates the level of cortisol produced in the body which in turn increases the brain function (Hall, 2007). Therefore, being involved in physical activities can have a positive effect on academic achievement (Shamsudin, Ismail, Al-Mamun and Bin Sayed Nordin 2014).

It is therefore not surprising that extracurricular activities are found in all levels of our universities in many different forms. They can be sports, clubs, debate, drama, school publications, student council, and other social events. A student’s future can be determined in the things that they do in the hours after lectures.

According to Daniyal, Nawaz, Hassan and Mubeen (2012) students involved in any kind of sports, participating in drama and other literary activities positively affects their academic performance, while watching television has some positive impact on academic performance.

In a study conducted in America at Purdue University, Hawkins (2011) found a relationship between involvement and grade point average (GPA). Student organization officials earned a significantly higher GPA than regular members of the organizations, while student organization members earned a significantly higher GPA than the general student population. Additionally, the study attempted to determine an optimal amount of involvement by testing the correlation between the number of organizations in which a student holds membership and term GPA. The results showed a very weak negative correlation. Therefore, the authors advocated for further research.

Baker (2008) found that the type of organization in which a student is a member does influence academic performance. Specifically, membership in academic organizations was found to be positively correlated with academic performance, whereas involvement in recreational organizations, including greek and intramural activities, was negatively correlated with academic performance. Participation in athletic and religious student organizations, on the other hand, was found to have no impact on students’ academic performance in their study. Contrary to Bakers finding, Shamsudin, Ismail, Al-Mamun and Bin Sayed Nordin (2014) found that physical, educational and social extra-curricular activities did not have a significant positive association with academic performance.

According to Zhao, (2005) social programs are related to the community or the university. Students volunteer for their own satisfaction or as a hobby to serve the community. It has been noted that academic gains are greatly influenced by students’ involvement in the academic and social activities of their institutions. Mehus (1934) suggests that students who engage in oratory and debate activities, publication and departmental clubs tend to perform better academically than those involved in athletics, music and drama. The difference in academic achievement between male students who were actively involved in fraternities and those who were not was not significant. But, women in sororities performed better than those who were
not, the same applies to male and female students who were involved in religious activities.

Strapp and Farr (2010) conducted a survey at Western Oregon University (WOU) on senior students majoring in psychology four weeks before they graduated. The students were satisfied with the quality of advice when they participated in internships, those who were club members reported better satisfaction with job market preparation. Those who took part in the study preparation group i.e. Psi Chi members, they reported that faculty was accessible and the courses were available. In general, psychology major senior students who were involved in activities related to their major course were satisfied and performed well. It can therefore be suggested that faculty and administrators should encourage students to get involved in major related extracurricular activities that will influence their academic success.

As indicated in this discussion. Studies have been carried out to identify and analyze the numerous extracurricular activities that positively or negatively affect academic performance in various centers of learning. However, there is lack of studies on the frequency of participating in extracurricular activity and mathematics success. This study will attempt to fill this gap in South Africa context in mathematics success for engineering and built environment students at the University of Johannesburg.

3. PROBLEM STATEMENT

Mathematics is viewed as important subject for students pursuing engineering courses. However, despite its importance students at high school have not been performing well according to the Department of Higher Education in South Africa. This same trend has been evident at tertiary institutions where mathematics is taught to engineering and built environment students. Furthermore, it can be indicated that researchers have conducted studies to determine the factors predicting academic achievement and to some extend mathematics success. These studies have established different determinants as predictors of passing mathematics in tertiary institutions. However, there is paucity of research relating the frequency of participating in particular extracurricular activity and mathematics success. This is a major gap in the current academic performance discourse. In relation to this gap, this study delved on two specific research questions i.e.

- What are the extra-curricular activities frequently undertaken by engineering and built environment students?
- Does the frequency of student participation in extra-curricular activity predict mathematics success?

Specific research objectives are:
To determine the frequent extra-curricular activities undertaken by engineering and built environment students; and

To establish if the frequency of participating in extra-curricular activities predicts mathematics success.

4. RESEARCH METHOD

The study population consisted of students from the department of civil engineering technology third years and construction management and quantity surveying third and second years. These were students attending the 2015 academic year in the faculty of engineering and built environment at University of Johannesburg. Using purposive sample, 199 students completed a questionnaire survey in the middle of the first semester of 2015. Two of the questionnaires were not suitable for analysis. The questionnaire included personal questions about age, gender, students' accommodation, education sponsor, entry to the university, final high school maths result, citizenship, weekly allowance and study skills, which are not discussed in this paper. The other section included extracurricular activities the students were involved while at the university. In the outcome variable the students were to indicate whether they passed mathematics at first attempt in the first major assessment at the end of the first semester. The response was either Yes or No. Statistical Package for Social Sciences (SPSS) version 22 was used to perform binary logistic regression analysis on this dichotomous outcome.

A binary logistic regression model with a dichotomous response of Yes or No was modeled. Yes response was defined as having passed mathematics at first attempt at the university. Students who did not pass at first attempt were considered to have failed hence responded as No. For the outcome analysis, the responses were coded as 1 and 0, respectively. The independent variables of the logistic regression model were extracurricular activities the students were involved in while studying the subject. The extracurricular activities were measured using five point Likert scale of 1 to 5.

Logistic regression is recommended over linear regression when modeling dichotomous responses and allows the researcher to estimate probabilities of the response occurring (Hosmer and Lemeshow, 2004). The logistic regression equation takes the following form

\[
\ln \left( \frac{p}{1-p} \right) = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \ldots + \beta_k x_k \quad (1.1)
\]

Where \( p \) is the estimated probability of passing, and \( x_1, x_2, \ldots, x_k \) are independent variables.

The estimated probability of the response occurring or passing (p) divided by the probability of it not occurring or not passing (1-p) is called the odds ratio. Maximum likelihood method is used to estimate the odds ratios of the model. Values of odds ratios higher than 1 indicate positive
association between the variables, odds ratios equal to 1 indicate no
association, while odds ratios lower than 1 indicate negative association
between each independent variable and the dependent variable of the
model. Furthermore, in order for an independent variable to be a predictor
of the dependent variable the \( p \)-value should be less than 0.05 at 95%
confidence, which connotes its significance in the model.

The Likert-scale questions on the frequently undertaken extracurricular
activity were discussed using their mean score in a developed ordinal scale
for this study. The difference between the upper and lower ends of the
used scale is 4.0 since there are five points. Each range can be equated to
0.80 because the extent of the range is determined by a division between
4.0 and 5.0 (4/5). However, in the current study the intervals are as stated:

\[
> 4.21 \leq 5.00 \text{ Always;} \quad > 3.41 \leq 4.20 \text{ Often;} \quad > 2.61 \leq 3.40 \text{ Sometimes;} \quad > 1.81 \leq 2.60 \text{ Seldom;} \quad > 1.00 \leq 1.80 \text{ Never.}
\]

5. RESULTS AND DISCUSSIONS

Table 5.1 indicates that male students are majority i.e. 60.4% pursuing civil
engineering and built environment courses at this comprehensive
university. Furthermore, 92.30% of the students are under the age of 25
years. It is interesting to note that of the 197 respondents only 155 students
revealed their age. 55.30% of the parents had tertiary qualification of this
percentage 32.50% had a university qualification. 48.70% of parents/guardians are responsible for their children university tuition fee. A meager 9.60% of students are self-sponsored. 52.80% of the respondents
have a weekly allowance of less than R200.00 as compared 9.8% of
students with an allowance more than R600.00. It is important to note that
only 26.90% of students are accommodated on campus.

<table>
<thead>
<tr>
<th>Table 5.1 Profile of respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Gender</strong></td>
</tr>
<tr>
<td>Male</td>
</tr>
<tr>
<td>Female</td>
</tr>
<tr>
<td><strong>Race</strong></td>
</tr>
<tr>
<td>Asian/Indian</td>
</tr>
<tr>
<td>African/Black</td>
</tr>
<tr>
<td>Coloured</td>
</tr>
<tr>
<td>White</td>
</tr>
<tr>
<td><strong>Age groups</strong></td>
</tr>
<tr>
<td>18-21 years</td>
</tr>
<tr>
<td>22-25 years</td>
</tr>
<tr>
<td>Over 26 years</td>
</tr>
<tr>
<td><strong>Parents highest education qualification</strong></td>
</tr>
<tr>
<td>No schooling</td>
</tr>
<tr>
<td>Elementary school</td>
</tr>
</tbody>
</table>
The findings in Table 5.2 indicated that students in this faculty are not participating adequately in extracurricular activities that were suggested in this study. The study revealed that students spending time in the residence chatting with friends was ranked 1st. However, the mean score was 2.31 in the band of 1.81 to 2.60. This suggests that students were almost never engaged in social discussion with their peers in their spare time. This is also true for students’ participation in clubs, societies and associations. Furthermore, there participation in sporting codes for example football, cricket was appalling a suggestion that students almost never participated. The students’ participation in voluntary work in their communities was sporadic in nature. However, it interesting to note that students were almost never working off-campus as the mean rating was 2.04. This is an indication that the opportunities for paid employment for these students off-campus were scarce. It can also be indicated that very few students were working on campus for payment. The mean rating was 1.38 which is in the band of 1.00 to 1.80. This suggests that at no time did the students work on campus for payment. This might be an indication that opportunities for paid employment on campus for students were rare or probably the students did not want to work. Hence, they would have probably preferred to focus on their education.

Table 5.2 Extracurricular activities

<table>
<thead>
<tr>
<th>Extracurricular activities</th>
<th>Mean</th>
<th>Std. dev.</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>I spent time in residence chatting with friends</td>
<td>2.31</td>
<td>1.154</td>
<td>1</td>
</tr>
<tr>
<td>I participated in student clubs, societies and associations</td>
<td>2.16</td>
<td>1.296</td>
<td>2</td>
</tr>
<tr>
<td>I participated in a sporting code e.g. football, cricket etc.</td>
<td>2.08</td>
<td>1.427</td>
<td>3</td>
</tr>
<tr>
<td>I worked off-campus for payment</td>
<td>2.04</td>
<td>1.389</td>
<td>4</td>
</tr>
<tr>
<td>I voluntarily worked in the community and in campus</td>
<td>1.97</td>
<td>1.293</td>
<td>5</td>
</tr>
<tr>
<td>I worked on-campus for payment</td>
<td>1.38</td>
<td>1.013</td>
<td>6</td>
</tr>
</tbody>
</table>
Binary logistic regression analysis was undertaken to establish if the frequency of participating in extracurricular activities predicted the success of mathematics at first attempt of these cohort of students. The result in Table 5.3 indicates that, when the frequencies of extracurricular activity participation were modelled with mathematics success, those who rarely participated in employment off campus for payment were likely to pass mathematics at their first attempt than those who never participated in off campus employment. The likelihood of passing mathematics at first attempt was 0.086 higher when the student rarely worked off-campus for payment than when they did not work off campus for payment. This independent variable was significant at 0.046 which was less than 0.05. The confidence interval (C.I.) was between 0.008-0.962. This suggests that the significance of the variable was within the appropriate range of the confidence interval. The participation level of students in the other extracurricular activities did not predict student success in mathematics at their first attempt.

### Table 5.3 Extracurricular activities predicting mathematics success

<table>
<thead>
<tr>
<th>Variable</th>
<th>Exp. (B)</th>
<th>95% C.I. for EXP (B)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>I voluntarily worked in the community and in campus</td>
<td>1.190</td>
<td>0.364-3.885</td>
<td>0.774</td>
</tr>
<tr>
<td>Seldom</td>
<td>3.440</td>
<td>0.767-15.424</td>
<td>0.107</td>
</tr>
<tr>
<td>Sometimes</td>
<td>3.265</td>
<td>0.360-29.652</td>
<td>0.293</td>
</tr>
<tr>
<td>Always</td>
<td>0.609</td>
<td>0.111-3.336</td>
<td>0.568</td>
</tr>
<tr>
<td>Spent time in residence chatting with friends</td>
<td>1.494</td>
<td>0.547-4.079</td>
<td>0.433</td>
</tr>
<tr>
<td>Seldom</td>
<td>2.183</td>
<td>0.733-6.501</td>
<td>0.161</td>
</tr>
<tr>
<td>Sometimes</td>
<td>3.127</td>
<td>0.636-15.372</td>
<td>0.161</td>
</tr>
<tr>
<td>Always</td>
<td>0.843</td>
<td>0.000-9.111</td>
<td>0.806</td>
</tr>
<tr>
<td>Participated in student clubs, societies and associations</td>
<td>1.369</td>
<td>0.421-4.457</td>
<td>0.602</td>
</tr>
<tr>
<td>Seldom</td>
<td>0.940</td>
<td>0.269-3.290</td>
<td>0.923</td>
</tr>
<tr>
<td>Sometimes</td>
<td>0.431</td>
<td>0.079-2.335</td>
<td>0.332</td>
</tr>
<tr>
<td>Always</td>
<td>0.716</td>
<td>0.129-3.991</td>
<td>0.703</td>
</tr>
<tr>
<td>Worked on-campus for payment</td>
<td>4.190</td>
<td>0.111-4.077</td>
<td>0.046</td>
</tr>
<tr>
<td>Seldom</td>
<td>1.003</td>
<td>0.166-6.070</td>
<td>0.997</td>
</tr>
<tr>
<td>Sometimes</td>
<td>5.750</td>
<td>0.000-111.508</td>
<td>0.130</td>
</tr>
<tr>
<td>Always</td>
<td>0.627</td>
<td>0.089-4.480</td>
<td>0.642</td>
</tr>
<tr>
<td>Worked off-campus for payment</td>
<td>7.800</td>
<td>0.546-111.508</td>
<td>0.130</td>
</tr>
<tr>
<td>Seldom</td>
<td>1.450</td>
<td>0.411-5.122</td>
<td>0.563</td>
</tr>
<tr>
<td>Sometimes</td>
<td>1.590</td>
<td>0.428-5.914</td>
<td>0.489</td>
</tr>
<tr>
<td>Always</td>
<td>2.740</td>
<td>0.425-17.674</td>
<td>0.289</td>
</tr>
<tr>
<td>Participated in a sporting code e.g. football, cricket etc.</td>
<td>0.387</td>
<td>0.098-1.527</td>
<td>0.175</td>
</tr>
<tr>
<td>Seldom</td>
<td>2.789</td>
<td>0.467-16.655</td>
<td>0.261</td>
</tr>
<tr>
<td>Sometimes</td>
<td>0.467</td>
<td>0.120-1.815</td>
<td>0.272</td>
</tr>
</tbody>
</table>
6. CONCLUSIONS AND RECOMMENDATIONS

The study revealed that of the six extracurricular activities analysed, students spending time in the residence chatting with friends was ranked higher. However, overall analysis suggests that the students rarely socialized verbatim with their peers in their free time. Furthermore, the finding suggests that students pursing civil and built environment courses rarely or were not participating in extracurricular activities on campus and off campus.

However, when the frequencies of extracurricular activity participation were modelled with mathematics success, those who rarely participated in off campus employment for payment were likely to pass mathematics at their first attempt than those who never participated in off campus employment for payment.

This study informs the university management to encourage its student body to promote students participation in extracurricular activities. It is disappointing to note that even with the availability different sporting disciplines and facilities on different campuses, they were rarely used. On the other hand students are rarely involved in clubs and societies despite these organizations being available on campus. However, despite the rarity of students participation on off campus employment for payment and deem to predict mathematics success at first attempt. This current finding should be implemented with caution as it may render some negative effect on the students if not addressed properly in any tertiary institution, let alone the current institution studied.

The researchers also propose the need to use other determinants in relation to the extracurricular activities in future models. The other factors recommended are socio-economic and demographic factors. Hence, further study is also recommended for all Engineering and Built Environment programs at the University of Johannesburg and other South African universities having similar programs.

<table>
<thead>
<tr>
<th>Always</th>
<th>0.518</th>
<th>0.101-2.660</th>
<th>0.430</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>2.143</td>
<td></td>
<td>0.042</td>
</tr>
</tbody>
</table>

Dependent variable: mathematics success (0=did not pass at first attempt; 1=passed at first attempt) sig. at 5%

It is imperative to note that, prior to testing the model in Table 3, the goodness of fit of the model was tested which indicated a good fit. This result was justified by the Hosmer and Lemeshow test. The significance of the model was greater than 0.05 at 0.185. Hence, indicating that the independent variables modeled were fitting in the proposed theoretical model.
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ABSTRACT

Purpose of the Paper

The Construction Management Programme (CMP) is a continued professional development programme for construction industry middle level managers. The programme is presently presented on an annual basis by the University of Stellenbosch and caters for the Building as well as the Civil Engineering sectors of the industry. The CMP financial management component of the curriculum has evolved and has been adapted and updated twice over the period of nearly thirty years since the programme started. The purpose of this paper is to analyse the past and present financial management curricula, to identify unique aspects of the curriculum and to provide pointers for possible updates and modifications to the curriculum.

The present format of the financial management curriculum for middle management development the CMP is reviewed. The present content of the module is designed to provide non-financial middle and senior managers with basic knowledge, understanding, and skills for capital budgeting, financial statement analysis, cash flow analysis and the valuation of companies.

Research methodology

Research on the financial management curriculum is conducted by referring to the archives of the CMP financial management curricula as well to other resources. A major update of the curriculum in 2014 excluded the study of basic accounting conventions and techniques as well as the
company accounts and the structure of the general ledger. A section on drivers of financial value and the valuation of companies was then added.

**Findings based on the empirical research**

By comparing the three available versions of the financial management curriculum of the CMP with other similar curricula, proposals for modification of the present financial management curriculum are formulated.

**Practical implications and outcomes**

The outcome of the research is a set of recommendations to the CMP management to drive renewal and base decisions on future changes and updates of the financial management curriculum for the CMP on.

**Keywords**

Education & training; Construction and engineering financial management, Curriculum development, Management Development

1  The Construction Management Programme (CMP)

The Construction Management Programme (CMP) is designed to develop middle management for the South African construction industry. It is a four week residential programme which covers a wide range of modules dealing with personal development, the construction business environment, business management and project management.

The programme was started in 1976 at the Graduate School of Business at the University of Cape Town and has been presented on a regular biannual basis since then. Faculty members for presentation of modules (academics as well as practicing engineers and managers) are drawn from a selection of institutions and organisations in South Africa and around the world.

Since 1987 the programme has been presented at Stellenbosch University. The programme is being presented on an annual basis since 2008. The programme was not presented in 2016 but will resume in 2017.

2  Context of the financial management curriculum of the CMP

The purpose of this paper is to provide an analysis of the development of the financial curriculum of the CMP and to compare the present curriculum
content with the historical content and typical generic engineering financial management curricula. A complete overview of the CMP curriculum and its development can be found in Strasheim and Wium (2015).

Figure 1 shows an overview of the typical components of a construction business financial system. The CMP financial management offering is linked to the management accounting and engineering economy / project discounted cash flow analysis modules of the course which are also indicated in Figure 1. The outlines of these modules are provided in Appendix A for reference purposes.

![Figure 1 Management and financial accounting data systems and reporting](image)

3 Scope of the financial management offering for the CMP

The CMP student/delegate target group for the financial management curriculum offering is middle to senior managers with a basic understanding of finance seeking greater understanding of financial management. These managers are not directly responsible for financial management as such. This is equivalent to a subset of the typical Master of Business Administration (MBA) candidate student group.

The didactical approach adopted for the CMP financial management modules is one where the teaching mode is prevalent. Student centred
learning approach components such as group work and hands on computer tutorials are also included. Introductory study material is issued to delegates two weeks before the start of the CMP course. The formal contact time available for presentation of the material amounts to 13 hours of lecture time with 3 hours scheduled supervised group work sessions. A short two hour test covering the pre-reading and presented material is included in the course. Since 2009 a hands on computer tutorial on interpretation of financial statements and ratio calculation is also included in the curricula.

4 Motivation of the inclusion of and content of the CMP financial management curriculum

Detail aspects of the CMP curriculum which make it unique includes inter alia the exposure of the delegates to the what, why, when, were and how of financial management. As stated by CMP faculty member Francois Swart (2015) - "If I want to be the Chief Executive Officer (CEO), I must understand finances".

Questions such as "Why must construction managers be exposed to and deal with accounting information at all?" and "Do only accountants deal with accounting?" need to be considered.

Business reality is that all higher level managers in organisations need to be able to deal with accounting concepts and practice. The project costing and accounting world are tightly linked. Managing the accounting process and interpreting and acting on accounting information is typically part and parcel of the day to day activities of managers in the construction industry.

When starting a construction business and being awarded a contract has extended financial implications. Aspects such as finance of capital, business working capital sourcing and control of working capital levels and cash flow, dealing with bankers, bookkeepers and auditors as well as the company directors, shareholders and financiers require extensive knowledge and skills for the construction professional.

A module on the publically listed companies on the Johannesburg Stock Exchange which is updated on an annual basis is also presented. Since 2013 a module on the financial engineering applied to private /public partnerships for infrastructure development was included in the CMP. Refer to Swart, (2015). Engineering management topics which can include financial modelling such as manufacturing management, product marketing as well as mathematical modelling of business processes are deemed to fall outside the scope of the CMP.
5 Typical engineering financial management curricula

The following subthemes of financial management curricula with a focus on the construction and engineering industry were identified with reference to typical textbooks on the subject such as Mazda (1998), Flynn (2007), Williams et al (2008) and Coombs and Palmer (1989).

- The mechanics of identifying recording and processing of financial transactions
- Financial system structuring, implementation and integration with other business systems with specific reference to the design of ledger structures
- The structure and content of financial reports e.g. the balance sheet, income statement and cash flow statement
- The interaction between costing, payroll, asset management systems and financial systems
- The impact of strategic, tactical and operational management decisions on the financial structure of an organisation
- Short term financial management including working capital, creditor, debtor and cash flow management
- Auditing of financial systems
- Analysis of financial statements including financial ratio analysis
- Analysis of financial statements of listed companies including market ratios
- Valuing of a business
- The impact of business structures, ownership and organisation structures on financial systems

<table>
<thead>
<tr>
<th>Table 1: Generic Financial Management Curriculum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Financial concepts</td>
</tr>
<tr>
<td>Mark-up and profit</td>
</tr>
<tr>
<td>Principles of risk and return.</td>
</tr>
<tr>
<td>Financial investments</td>
</tr>
<tr>
<td>Taxes</td>
</tr>
<tr>
<td>Business Ownership and Organisations</td>
</tr>
<tr>
<td>The Language of Accounting</td>
</tr>
<tr>
<td>Financial statements</td>
</tr>
<tr>
<td>Financial Analysis and Ratios</td>
</tr>
<tr>
<td>Basic Costing Principles</td>
</tr>
<tr>
<td>Budgeting and Profit Planning</td>
</tr>
<tr>
<td>Cash Budgeting</td>
</tr>
<tr>
<td>Capital Budgeting and Time Value of Money</td>
</tr>
<tr>
<td>Valuing a business</td>
</tr>
</tbody>
</table>
Table 1 contains an outline of a typical generic engineering financial management curriculum as outlined in Mazda, 1998.

6 Review of the CMP financial management curriculum from 1990 to 2015
A historical review of the content and structure of the CMP financial management curriculum from 1990 to 2015 is provided in this section.

6.1 Structure of the CMP financial management curriculum from 1990 to 2007
Table 2 provides an overview of the CMP financial management curriculum as presented by Prof Willie Hamman (Hamman, 1990) of the Stellenbosch Business School for the CMP until 2007.

Table 2: CMP Financial Management Curriculum 1990 to 2007

<table>
<thead>
<tr>
<th>Interrelationship of financial decisions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accounting terms Afrikaans / English versus North American usage</td>
</tr>
<tr>
<td>Equivalent definitions for accounting concepts and terms</td>
</tr>
<tr>
<td>Financial statements with case study applications to listed construction and other companies</td>
</tr>
<tr>
<td>Balance sheet format and content</td>
</tr>
<tr>
<td>Income statement format and content</td>
</tr>
<tr>
<td>Vertical and horizontal analysis of financial statements</td>
</tr>
<tr>
<td>Calculation of growth rates</td>
</tr>
<tr>
<td>Ratio analysis and market based per share calculations</td>
</tr>
<tr>
<td>Purpose of ratio analysis: To compare a company against itself over time, opposition, industry, and performance norms</td>
</tr>
<tr>
<td>Liquidity ratios</td>
</tr>
<tr>
<td>Leverage or debt ratios</td>
</tr>
<tr>
<td>Activity ratios</td>
</tr>
<tr>
<td>Profitability ratios</td>
</tr>
<tr>
<td>Market ratios such as: Earnings per share, Net asset value per share, Price Earnings ratio</td>
</tr>
<tr>
<td>Company annual report structure and content</td>
</tr>
<tr>
<td>Financial statements</td>
</tr>
<tr>
<td>Director’s report</td>
</tr>
<tr>
<td>Chairman’s review</td>
</tr>
<tr>
<td>Statistics</td>
</tr>
<tr>
<td>Interpretation of balance sheet information</td>
</tr>
<tr>
<td>Cash flow calculations and working capital requirements</td>
</tr>
</tbody>
</table>

Pre course work was issued to the students in the form of a selection of the programmed learning books by Boland (1969).

A short test on the pre reading was included in the module.
6.2 Structure of the CMP financial management curriculum from 2008 to 2013

The structure of the previous CMP financial management curriculum is outlined here. Some of these aspects are expanded on in section 7. The key components of the curriculum and the activities associated with it are the following:

- Basic accounting techniques
- Structuring a general ledger
- Basic accounting statements;
- Analysis of financial statements;
- Budgets and cash flow;
- Discounted cash flow calculations with applications;
- Financial analysis of listed companies;
- Management and cost accounting;
- Valuation of companies and businesses;
- Computer based tutorial on discounted cash flow and statement ratio analysis; and
- Written test on financial management.

6.3 Structure of the CMP financial management curriculum from 2014 to 2015

The structure of the present CMP financial management curriculum given by Burger (2014) is outlined below. The CMP financial management module is designed to provide non-financial middle and senior managers with advanced knowledge, understanding, and skills of capital budgeting, financial statement analysis, cash flow analysis and the valuation of companies.

6.3.1 Purpose of the financial management module

The module is designed to lead the delegates to:

- Analyse and understand the strategic context of the organization and industry
- Execute an advanced financial ratio analysis and interpret the ratios
- Analyse and interpret the cash flow position of an organization
- Analyse and evaluate the financial viability of selected projects
- Explain the drivers of a company's cost of capital and calculate the cost of capital
- Determine the value of a company based on the discounted cash flow method
- Analyse and understand the drivers of the value a company in general
6.3.2 Specific Outcomes of the Module
The planned outcomes of the module in terms of the knowledge, skills and attitudes of delegates are to:

- Understand the financial implications of the drivers of value within the strategic paradigm
- Identify the drivers of value within the context of the company
- Understand and develop appropriate responses to issues identified in the financial statements
- Calculate, understand and develop appropriate responses identified during the calculation of financial ratios
- Identify and manage the drivers of cash flow of the company, given the nature of the industry
- Calculate the Break-even, Discounted Break-even, Net Present Value and Internal Rate of Return of identified projects
- Calculate the value of the company using the Discounted Cash Flow Method
- Calculate the Weighted Average Cost of Capital and Return on Equity

6.3.3 Module content
The present CMP finance module content consists of study material and presentation to aid the delegate to understand and manage:

- the link between Context, Strategy and Finance
- the Balance Sheet
- the Income Statement
- the Cash flow and the Cash Flow Statement
- the Financial Ratios of the company
- the calculation of the drivers of the Weighted Average Cost of Capital
- the Drivers of Finance in the business model
- the Time Value of Money
- applying the Break-even, Discounted Break-even, Net Present Value and Internal Rate of Return as methods of determining the financial viability of a project
- the calculation of the value of the company using the Discounted Cash Flow Method
- the development of an holistic view of the world of finance though understanding the Return on Strategic Effectiveness

7 Detail review of the content of selected CMP financial management modules

As stated in Strasheim and Wium (2015) the CMP Financial Management modules were revised in 2013 and the basic bookkeeping component of the module removed. The focus is now on ‘Finance for non-financial managers' with the curriculum outline in section 6.
Selected detail sub module contents of the CMP financial management offering which needs consideration for inclusion / exclusion in the CMP financial management offering is discussed below.

7.1 Basic accounting techniques and statements

Basic accounting skills and knowledge dealt with in this module include:

- Accounting as the language of business and accounting processes
- The audience of the accounting process and documentation produced
- The balance sheet and income statement concepts of double entry and debit and credit transactions
- The concept of debit and credit and accounting statements
- Journals and general ledgers and balancing of accounts
- The format and structure of the general ledger Assets Liabilities Owners Equity (Capital) Income (Revenues) Expenses Balance sheet accounts – assets, liabilities, owner's equity Income statement accounts – Income and expenses.

A full accounting example with transaction recording and setting up transaction journals for general ledger and generation of trial balance, income statement, balance sheet and cash flow statement is also presented.

7.2 Structuring a general ledger

In this module the logical structure of a general ledger is presented to the students. The key importance of this component of a financial system to provide support for business financial reporting detail is highlighted.

The logical structuring of the ledger to reflect the business structure as shown in Figure 2 is highlighted in the study material. The reflection of the construction business logic with organisational or reporting units, objects and activities viewed by projects and/or sites, regions and offices, which have a demarcated physical presence to support business activities and technical project disciplines which represent a logical grouping across activities i.e. civil, mechanical and electrical, is indicated in Figure 2.
Figure 2 Concept general ledger structure requirements to support financial reporting

The ledger structuring topics dealt with include:

- Balance sheet: Company sections, Office sections
  - Sections linked to project management and costing
  - Section linked to fixed asset management system
- Income statement: Company sections, Office sections
  - Sections linked to project management and costing
  - Sections linked to payroll system
- Account numbering and structure used to aid reporting functionality of accounting system
- Office accounts block to be repeated per office with suitable numbering and account structure
- Management accounting integration:
  - Integrated cost accounting system versus interlocking cost accounting system
- Office / company allocation of accounts to be matched to management responsibility assignment:
  - What is office manager responsible for?
  - What is company manager responsible for?
  - What is project manager responsible for?
  - What is facility manager responsible for?

Full examples are provided of a typical construction business general ledger structure and a professional service business general ledger structure.
7.3 **Budgets and Budgetary Control**

The sub module on budgets and budgetary control deals with the following topics:

**Motivation for budgeting**
- Creation of formal planning framework with timing deadlines
- Quantification of objectives
- Creation of focus on company goals
- Co-ordination of company activities
- Performance evaluation
- Creation of cost awareness among personnel and managers
- Budgeting for a going concern
- Budgeting as part of a new business planning exercise
- Project budgeting

**Budgetary functions**
- Financial control by financial managers and management accountants
- Management control by line and general managers
- Financial control based on master budget, sales budget, debtors, creditors, inventory and cash flow budget.
- Management control of the day to day operations of the company to ensure that plans are implemented and targets are met.

**Budgets as a basis to quantify company plans**
- Strategic plans – long term company objectives
- Operating plans – Production and investment objectives of the company
- Administrative plans – Development and maintenance of the structure of the company
- Marketing and sales plans follow from strategic plans

Two case studies for a production operation and a construction project are included.

**Components of a typical production budget dealt with are the:**
- Sales budget
- Production cost schedule
- Finished goods budget
- Production budget
- Raw materials stock budget
- Raw materials purchase budget
- Labour budget
- Budget income statement

**Additional topics on budgets and budgetary control**

Additional topics on budgeting techniques which are not dealt with are flexible budgets, zero-based budgets and activity based budgets.
7.4 **Cash Budgets and Cash Flow**

The sub module on cash budgeting and cash flow deals with the following topics.

**Flow of cost and revenue**
- Cash pipeline with control valves model
- Basic funds and cash cycles
- Operations cycle expenses filling Work in Process (WIP)
- Invoicing and debtor payment cycle
- Ordering and creditor payment cycle
- Capital provision cycle - Long term and Short term overdraft and loans
- Capital drawings and dividend allocation cycle

Why is cash budgeting necessary?
- Cash flow models
- Techniques for improving cash flow

**Why is cash budgeting necessary?**
- Identify undercapitalisation i.e. inadequate working capital situation
- Financing rapid growth where WIP and debtors increase due to increased turnover and seasonal patterns of demand and payments to creditors need adequate temporary borrowings

**Techniques for improving cash flow**
- Negotiate profitable pricing of services
- Tighten credit evaluation
- Invoice promptly
- Write off WIP which cannot be invoiced
- Follow up debtors
- Review creditor payment terms
- Study payment approval process at customers
- Review creditor payment terms and delay payment to suppliers
- Reduce inventory
- Forecast and monitor cash movements

A full cash budgeting and cash flow example case study with a marketing plan, projected project income schedule and cash flow budget is dealt with.

The development of module content as well as introduction of new modules and discontinuation of some modules was required to keep the CMP relevant with reference to the changing business and technological environment. The sub modules which deal with the accounting process i.e. debit and credit transactions and the development of the trail balance as well as the structuring of the general ledger was excluded from the CMP offering from 2013 onwards.
The computer laboratory tutorial session exposing students to spread sheet based discounted cash flow calculations as well as financial ratio calculations and interpretation was added to the suite of financial modules.

8 Discussion of the content of the CMP Financial Management Curriculum

The 2015 curriculum now includes material of a more strategic nature which focuses on the financial aspects which drive the value of a business. This was perceived to be a positive development.

The detailed budgeting and cash management modules presented complement the present higher level finance component of the curriculum. The introduction of the module on finance and private / public partner projects showed delegates how financing know how is applied in practice. It also serves as further motivator for the curriculum content.

Discussion by the authors of this paper with students during the 2015 CMP indicated that quite a number of organisations are experiencing difficulties with the implementation of integrated business systems which link project and business financial systems. It would be beneficial for students to be exposed to the important aspects of financial system design to be able to relate to the issues which go with the implementations of these integrated systems.

It seems if the section in the 1990 curriculum which dealt with the financial impact of business decision i.e. both business finance as well as working capital implications is not contained in the present curriculum. Students indicated to the authors of his paper that exposure to spread sheet based financial calculations tutorial work enhanced their understanding of the subject material to a large extent.

It must be added, that delegates annually find the financial management content of the CMP rather challenging. They then question the need for the inclusion of the module in the curriculum, probably because at middle management level they may not have been exposed to financial business management yet, but soon would be. Nevertheless, the CMP Advisory Board annually emphasise the importance of the module, and strongly support the inclusion thereof in the curriculum.

9 Conclusion and Recommendations

Proposals for consideration on updating the present CMP financial management content which have been identified are:
1. Re-introduction of the sub module which deals with financial system structures to support managers which are exposed to integrated system implementations.

2. Further linking of other modules the financial management modules to expose students to the practical application of financial modelling and calculations.

3. Exposure to case studies showing the application of the concepts dealt with in the section on strategic drivers of financial value of an organisation. The section on the impact financial decisions on the finances of a business needs to be extended.

4. A review of the didactical approach adopted for the financial management modules indicate that the teaching mode is still prevalent and that the student centred learning approach components of the module needs to be extended and enhanced. The enhancement of the student-centred group and tutorial components of the Financial Management Module needs to be considered. It is recommended that more time is allocated (perhaps in the form of tutorials) to enable better absorption of the learning material.

5. Maintaining the sub modules on budgeting and cash management to provide subject material for hands on computer tutorial sessions.

It is recommended that at the annual review of the CMP curriculum focus is placed on developments in the industry but also that the business environment in general as outlined above be considered to determine what changes are required for the curriculum in the future.
10 References


CMP – CMP Academic Manuals 2005 to 2015


Davhu Taining Consulting – Financial Management Training for Engineers and Technicians Course outline – July 2014


Frank Harris, Ronald McCaffer, Modern Construction Management. E-book Blackwell, 2013


Appendix A

**A1. Management and Cost Accounting Curriculum**

<p>| | |</p>
<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Costing concepts, Cost accounting and Cost control</td>
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<tr>
<td>Production Cost Accounting</td>
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<tr>
<td>Construction contract costing systems</td>
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<tr>
<td>Interim valuations</td>
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</tr>
<tr>
<td>To understand the primary work of the Financial Officer and the Management Accountant of a business entity</td>
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</tr>
<tr>
<td>To become familiar with several of the concepts used in Management Accounting</td>
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<tr>
<td>To study methods for classifying and allocating costs</td>
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<tr>
<td>To review the process of budgeting and cost control at company level</td>
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<tr>
<td>To understand the techniques involved in sales, operating, capital expenditure and master budget preparation</td>
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<tr>
<td>To understand the concept and importance of working capital, cash-flow and cash flow forecasts for business management and business activities</td>
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<tr>
<td>To understand the concept of working capital and capital lock-up linked to cash flow</td>
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<tr>
<td>To review the process of interim contract valuations</td>
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<tr>
<td>To study basic job cost accounting techniques applied to the production environment</td>
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</tbody>
</table>

**A2. Engineering Economy / Discounted Cash Flow Analysis Curriculum**

<p>| | |</p>
<table>
<thead>
<tr>
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<tbody>
<tr>
<td>To review the concepts of and techniques used in discounted cash flow calculations</td>
<td></td>
</tr>
<tr>
<td>Compound interest and compound amounts</td>
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<tr>
<td>Present worth</td>
<td></td>
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<tr>
<td>Compound amount of uniform series cash flow</td>
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<tr>
<td>Topic</td>
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<tr>
<td>----------------------------------------------------------------------</td>
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<tr>
<td>Sinking fund deposits</td>
<td></td>
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<tr>
<td>Present worth of uniform series cash flow</td>
<td></td>
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<tr>
<td><strong>To understand economic equivalence and economic comparisons</strong></td>
<td></td>
</tr>
<tr>
<td><strong>To review engineering economic analysis and assessment techniques</strong></td>
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<tr>
<td>Asset or process replacement analysis</td>
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<td>Public sector Cost benefit analysis</td>
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<tr>
<td>Cost volume profit breakeven analysis</td>
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<tr>
<td>Sensitivity analysis, impact of cost of capital, inflation, taxes</td>
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<tr>
<td>Applications in risk analysis</td>
<td></td>
</tr>
<tr>
<td>Life cycle costing</td>
<td></td>
</tr>
<tr>
<td><strong>To develop basic skills in using Microsoft Excel for discounted cash flow computations</strong></td>
<td></td>
</tr>
<tr>
<td>One computer laboratory session in tutorial format.</td>
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</tbody>
</table>
Relationship between classroom climate, student self-efficacy and mathematics achievement at Mangosuthu University of Technology (MUT)

Theo C. Haupt¹ and Ravi Chetty²

¹ Professor, Construction Studies Program, University of KwaZulu-Natal, Howard College, Durban 4001, South Africa. (Tel: +27 31 2602712)

² Visiting Research Professor, Department of Construction Management and Quantity Surveying, Mangosuthu University of Technology, Umlazi, Durban 4026, South Africa. (Tel: +27 31 9077557)

ABSTRACT AND KEYWORDS

Purpose: The objective of this study was to determine whether the perceptions of construction students which include civil engineering, construction management and quantity surveying students at university of their mathematics classroom climate were related to their self-efficacies toward the subject and whether this relationship affected their achievement in mathematics. Aspects such as mathematics self-efficacy, instructor mastery goal structure, instructor challenging and instructor caring are explored.

Design/methodology/approach: A sample of 98 students registered for the National Diploma: Building and National Diploma – Civil Engineering at Mangosuthu University of Technology (MUT) were surveyed using a 16 scaled item instrument to measure classroom climate, mathematics self-efficacy and achievement. The response rate was 100%.

Research limitations: The sample of students were drawn from the MUT only despite being in multiple departments.

Findings: Preliminary findings suggest that that there was a significant relationship between student mathematics self-efficacy and mastery goal structure, appropriate challenges and caring. A significant relationship was
found between self-efficacy and student achievement measured by their grades.

Response to conference theme: The findings of the study may point the way to improved performance of construction students in mathematics when developing interventions.

Practical implications: The findings are indicative of potential improvement of the performance of construction students in mathematics driven by interventions such as introduced by mathematics instructors.

Keywords: Mathematics, Self-efficacy, classroom climate, academic performance

Introduction

A substantial knowledge of mathematics is critical for career and job opportunities generally (Peters, 2013) and especially in construction. Mathematics proficiency is necessary (Augustine, 2007). Research has shown that the lack of self-efficacy relating to mathematics is a strong contributor to why students do not succeed in mathematics (Peters, 2013). To build self-efficacy mathematics instruction needs to be augmented by a classroom climate created by instructors which addresses the development of self-efficacy in mathematics. The interventions of instructors must include mastery goal structures, appropriate challenges for the students and caring. This study sought to determine whether the perceptions of construction students of their mathematics classroom climate were related to their self-efficacies toward the subject and whether this relationship affected their achievement in mathematics. Aspects such as mathematics self-efficacy, instructor mastery goal structure, instructor challenging and instructor caring are explored.

Self-efficacy

Self-efficacy is described as the ability to organise and execute courses of action required to produce given attainments (Bandura, 1977). Student self-efficacy refers to beliefs about what students are capable of accomplishing, rather than what skills and abilities they think they possess (Bandura, 1986). Self-efficacy has been found to relate positively to intrinsic motivation, career selection, choice of tasks, task values, and persistence. It was also found to have a direct effect on persistence (Robbins, Allen, Casillas, Petersen and Le, 2006). Self-efficacy is one of the affective variables used to explain academic achievement and has been found to positively affect academic achievement (Fetahloglu, Güven, İnce, Sert and Aydogdu, 2011; and Komarraju and Nadler, 2013). Having high self-efficacy in mathematics means that students feel confident in their ability to be successful in the subject which motivates them to approach
challenges and raise their prospects of being successful (Bandura, 1986). Self-efficacy in mathematics would determine whether students would persist in completing mathematics coursework successfully (Larson, Pesch, Surapaneni, Bonitz, Wu, and Werbel, 2015). There are four contributing factors to self-efficacy, namely

- Mastery experiences – experiences that show students they can complete a task successfully;
- Vicarious experiences – watching other students of similar skill complete a task successfully makes them feel they can do the same;
- Social persuasion – when peers or mentors encourage students doing a task that they can do it; and
- Emotional states – positive thinking increases self-efficacy while too much stress lessons self-efficacy (Ibid).

In their study Fast, Lewis, Bryant, Bocian, Cardullo, Rettig and Hammond (2010) found that mastery goal structure, \[\text{instructor}\] challenge and \[\text{instructor}\] care significantly influenced mathematics self-efficacy. Where these were present or evident students had higher levels of mathematics self-efficacy than when they were not.

Individual efficacy has been found to have the strongest influence to student mathematics achievement (Pina_Neves, Faria and Raty, 2013).

**Classroom climate**

Classroom climate has been defined by Bierman (2011) as the classroom environment, the social climate, the emotional, and the physical aspect of the classroom. Patrick, Kaplan and Ryan (2011) describe it as learning environments. Student-instructor relationships are therefore important. The climate created in the classroom by the instructor through goal-setting, appropriate challenges and empathy for the students may contribute to student achievement (Ibid). Student efficacy or confidence is the perceived capability of the student for a specific task or subject such as mathematics. It is possible for instructors to influence student self-efficacy within the classroom climate that they create. Instructor interactions are important to the perceptions of students of the classroom. Arguably, instructors should be careful to avoid making mathematics more difficult and stressful for students. They should rather increase their confidence and self-efficacy in mathematics (Ibid).

**Mastery goal structure**

According to Patrick, Kaplan and Ryan (1011), mastery goal orientation refers to the development of competence. Goal theory assumes that the

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1 Italics by author
motivation of students is influenced not only by their individual dispositions and beliefs but also by the environment that they are in. A mastery goal involves a perception that the real learning and understanding of students rather than memorization are valued and that success is accompanied by effort and indicated by personal improvement or by achieving absolute standards. It is also evident that students in the same class do not necessarily perceive instructor practices in the same way. Instructor mastery goal structure involves the extent to which the instructor wants students to learn and understand or to enjoy learning things. Studies have found positive relations between mastery goal structure and self-efficacy and achievement (Murdock, Hale and Weber, 2001; Nolen, 2003; Wolters, 2004). In general, mastery goal structure is associated with the beliefs and behaviors of students (Ur dan and Midgley, 2003). Therefore, in order to create positive and learning environments the focus has to be on establishing a mastery goal structure (Patrick, Kaplan and Ryan, 2011). Instructor support, respect and positive affect were key factors in classrooms with high mastery goal structure. Instructors in these types of classrooms tended to encourage students to help each other and explain their reasoning (Ibid).

**Student-instructor relationship**

The motivation of students for schoolwork is positively related to to their perception of their instructors as being emotionally supportive (Skaalvik, Federici and Klassen, 2015). A positive student-instructor relationship fosters growth in confidence and self-efficacy (Peters, 2013). Emotionally supportive involves warmth, friendliness, respect, empathy and care (Patrick, Kaplan and Ryan, 2011). The relationship between students and their instructors reflects the potential of classroom interactions to foster their development. Further, positive relations have been shown to to be positively associated with student motivation, engagement, and well-being (Sakiz, Pape and Hoy, 2012). Instructors need to find the balance between challenging and caring by believing in their students and helping them achieve their academic goals (Peters, 2013). Students who perceive their instructors to be caring and supportive tend to be more motivated by exerting greater effort and persistence.

This study examines the relationships between mathematics self-efficacy, instructor mastery goal structure, instructor challenging and instructor caring.

**Research approach**

A convenience sample was surveyed comprising of 89 students registered in the Department of Construction Management and Quantity Surveying and Department of Civil Engineering at Mangosuthu University of
Technology in Umlazi in the KwaZulu-Natal province of South Africa who had completed the mathematics component of their academic programs. While the larger study included several other universities, this paper reports only those at MUT. These students for inclusion in the survey sample had to have completed modules in mathematics. They were surveyed about their views and experiences of the mathematics classes. The data was collected via a quantitative questionnaire survey comprising of 16 statements and information about four constructs, namely mastery goal structure, instructor challenge, instructor care and self-efficacy based on Fast’s 2010 study with each construct comprising of four statements (Fast et al., 2010; Skaalvik and Skaalvik, 2013). Each of the statements required a scaled response of agreement. Descriptive statistics were derived using SPSS v23 and presented including measures of central tendency and dispersion. The internal validity of scaled responses was determined by the Cronbach’s alpha co-efficient for validity.

Research findings

Profile of students

Most students (86.5%) were in their second year of study suggesting that their experience of the mathematics module would still be fresh in their minds. Almost two-thirds of the students (64.8%) were doing civil engineering. Male students (56.3%) outnumbered the female students. Students had either taken MATHEMATICS 1 (64.8%) or Applied Building Science (35.2%). Most male students (81.3%) were in their second year of study, were doing civil engineering (81.3%), and had either taken MATHEMATICS 1 (81.3%) or Applied Building Science (18.7%). Almost all female students (92.1%) were in their second year of study. Most were doing civil engineering (47.4%), and had either taken MATHEMATICS 1 (47.4%) or Applied Building Science (56.6%).

Reliability

Table 1 shows the Cronbach’s alpha co-efficient for the scaled responses that make up each of the four constructs for the whole sample, male and female students.

<table>
<thead>
<tr>
<th>Construct</th>
<th>Cronbach alpha</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematics self-efficacy</td>
<td>0.854</td>
</tr>
<tr>
<td></td>
<td>0.858</td>
</tr>
</tbody>
</table>

2 Normal font=sample response; bold font=male student response; and italicized font = female response
There is an acceptable degree of internal consistency for each set of the scales used, namely a Cronbach Alpha statistic which is greater than the rule-of-thumb 0.700 for acceptable internal scale consistency. The scales used are therefore acceptable in their measure of the reliability of the constructs. There appears to be strong internal consistency of the scaled responses for mathematics self-efficacy across the three groups, namely the whole sample, males and females. With respect to the other constructs in each case the internal consistency of female responses was higher than male responses.

**Mathematics self-efficacy and instructor role**

Students were asked, on a 7-point Likert scale with 1 = strongly disagree and 7 = strongly agree, to what extent they agreed with 16 statements on student mathematics self-efficacy, perceptions of instructor mastery goal structure, perceptions of instructor challenge and perceptions of instructor caring and instructor role. The student responses are shown in Table 2. It appears that students tended to somewhat agree with the statements making up the constructs of instructor goal mastery structure (mean=5.67), instructor challenge (mean=5.21), and mathematics self-efficacy (mean=5.12). Instructor caring (mean=4.45) was the construct they agreed least with. There were gender differences in the levels of agreement with females having higher levels of agreement with instructor goal mastery structure, instructor challenge and instructor caring and males higher levels of agreement with mathematics self-efficacy.

Within the construct mathematics self-efficacy, there was the most agreement with *I am sure I can learn everything taught in Mathematics* and least agreement with *I am sure that I can do even the most difficult work in my Mathematics class*. Males had higher levels of agreement with all statements in this construct.

Within the construct instructor goal mastery structure, there was the most agreement with *My instructor thinks it is important to understand the material and not to just memorize it* and least agreement with *My mathematics instructor accepts nothing less than my full effort*. Females had higher levels of agreement with all statements in this construct.

<table>
<thead>
<tr>
<th></th>
<th>Cronbach Alpha</th>
</tr>
</thead>
<tbody>
<tr>
<td>Instructor mastery goal</td>
<td></td>
</tr>
<tr>
<td>structure</td>
<td>0.758</td>
</tr>
<tr>
<td></td>
<td>0.748</td>
</tr>
<tr>
<td></td>
<td>0.788</td>
</tr>
<tr>
<td>Instructor challenge</td>
<td>0.867</td>
</tr>
<tr>
<td></td>
<td>0.821</td>
</tr>
<tr>
<td></td>
<td>0.908</td>
</tr>
<tr>
<td>Instructor care</td>
<td>0.771</td>
</tr>
<tr>
<td></td>
<td>0.721</td>
</tr>
<tr>
<td></td>
<td>0.834</td>
</tr>
</tbody>
</table>
Within the construct instructor challenge, there was mixed levels of agreement with all statements. There tended to be the most consensus with My mathematics instructor pushes me to take on challenging work. Females had higher levels of agreement with all statements in this construct.

Within the construct instructor caring, there was the most agreement with I feel that my mathematics instructor will go above and beyond to help students and least agreement with My mathematics instructor take a personal interest in students. Females had higher levels of agreement with all statements in this construct.

Table 2. Classroom climate, self-efficacy and instructor role (n=89; n=49; n=38)

<table>
<thead>
<tr>
<th>Statement</th>
<th>Mean</th>
<th>Std Dev</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mathematics self-efficacy</strong></td>
<td>5.12</td>
<td>1.29</td>
<td>3</td>
</tr>
<tr>
<td>I am sure I can learn everything taught in Mathematics</td>
<td>5.41</td>
<td>1.31</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>5.24</td>
<td>0.98</td>
<td>3</td>
</tr>
<tr>
<td>I am sure I can do even the most difficult work in my Mathematics class</td>
<td>5.62</td>
<td>1.30</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>5.64</td>
<td>1.54</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>5.61</td>
<td>0.97</td>
<td>1</td>
</tr>
<tr>
<td>Even if a new topic in mathematics is difficult I am sure that I can learn it</td>
<td>4.94</td>
<td>1.55</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>5.06</td>
<td>1.71</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>4.82</td>
<td>1.35</td>
<td>4</td>
</tr>
<tr>
<td>I am sure that I can figure out the answers to problems that my instructor gives me in class</td>
<td>5.49</td>
<td>1.21</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>5.53</td>
<td>1.32</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>5.39</td>
<td>1.05</td>
<td>2</td>
</tr>
<tr>
<td><strong>Instructor mastery goal structure</strong></td>
<td>5.67</td>
<td>1.24</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>5.81</td>
<td>1.23</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>6.13</td>
<td>0.97</td>
<td>1</td>
</tr>
<tr>
<td>My instructor thinks that really understanding the material is the main goal of the class</td>
<td>5.80</td>
<td>1.43</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>5.69</td>
<td>1.45</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>5.92</td>
<td>1.44</td>
<td>3</td>
</tr>
<tr>
<td>My instructor thinks it is important to understand the material and not to just memorize it</td>
<td>6.29</td>
<td>1.36</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>6.12</td>
<td>1.60</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>6.47</td>
<td>0.98</td>
<td>1</td>
</tr>
<tr>
<td>My instructor thinks how much you improve in Mathematics is really important</td>
<td>6.11</td>
<td>1.34</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>6.04</td>
<td>1.55</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>6.24</td>
<td>1.00</td>
<td>2</td>
</tr>
<tr>
<td>My mathematics instructor accepts nothing</td>
<td>5.60</td>
<td>1.71</td>
<td>4</td>
</tr>
</tbody>
</table>

3 Normal font=sample response; bold font=male student response; and italicized font = female response
<table>
<thead>
<tr>
<th>Table 2. Continued</th>
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<tbody>
<tr>
<td><strong>Instructor challenge</strong></td>
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<tr>
<td><strong>When I have figured out how to do a mathematics problems my instructor gives me more challenging work</strong></td>
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<td></td>
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<tr>
<td><strong>My mathematics instructor does not let me get away with doing easy work</strong></td>
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<td></td>
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<tr>
<td><strong>My mathematics instructor pushes me to take on challenging work</strong></td>
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<td></td>
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<tr>
<td><strong>My mathematics instructor makes sure that the work I do really makes me think</strong></td>
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<td></td>
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<tr>
<td><strong>Instructor caring</strong></td>
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<td></td>
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<tr>
<td><strong>My mathematics instructor take a personal interest in students</strong></td>
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<td></td>
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<tr>
<td><strong>My mathematics instructor cares about how I feel</strong></td>
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<td></td>
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<tr>
<td><strong>My mathematics instructor listens to what I say</strong></td>
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<tr>
<td></td>
</tr>
<tr>
<td><strong>I feel that my mathematics instructor will go above and beyond to help students</strong></td>
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<tr>
<td><strong>Grade expected</strong></td>
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<td></td>
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<tr>
<td><strong>Grade achieved</strong></td>
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</tbody>
</table>

There were differences between the grade expected and the grades achieved with females showing the smallest difference (5.8%). The difference for males was 9.1%. Males also had the higher grade expectancy but the lowest grade achievement.
Correlations between all the constructs including gender, grade expectation and grade achievement were examined. The outcomes using Pearson’s correlations are shown in Table 3.

Table 3. Correlations (n=894; n=49; n=38)

<table>
<thead>
<tr>
<th>Construct</th>
<th>Mathematics efficacy</th>
<th>Instructor goal mastery structure</th>
<th>Instructor challenge</th>
<th>Instructor caring</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematics efficacy (where’s the female response?)</td>
<td>0.287** 0.006</td>
<td>0.305** 0.004</td>
<td>0.306** 0.004</td>
<td>0.406* 0.11</td>
</tr>
<tr>
<td>Instructor goal mastery structure</td>
<td>0.347* 0.015</td>
<td>0.377** 0.007</td>
<td>0.342* 0.016</td>
<td></td>
</tr>
<tr>
<td>Instructor challenge</td>
<td>0.634** 0.000</td>
<td>0.471* 0.000</td>
<td>0.616** 0.000</td>
<td>0.648** 0.000</td>
</tr>
<tr>
<td>Instructor caring</td>
<td>0.648** 0.000</td>
<td>0.471* 0.000</td>
<td>0.616** 0.000</td>
<td>0.648** 0.000</td>
</tr>
<tr>
<td>Grade expected</td>
<td>0.236* 0.028</td>
<td>0.324* 0.025</td>
<td>0.324* 0.025</td>
<td></td>
</tr>
<tr>
<td>Grade achieved</td>
<td>0.214* 0.046</td>
<td>0.319** 0.002</td>
<td>0.319** 0.002</td>
<td>0.356* 0.028</td>
</tr>
</tbody>
</table>

* Correlation is significant at the 0.05 level (2-tailed)

4 Normal font=sample response; bold font=male student response; and italicized font = female response
**Correlation is significant at the 0.01 level (2-tailed)**

From Table 3 it is evident that for the whole sample, instructor goal mastery structure ($r=0.287, p<0.006$), instructor challenge ($r=0.305, p<0.004$) and instructor caring ($r=0.306, p<0.004$) are significantly correlated with mathematics efficacy; instructor challenge ($r=0.634, p<0.000$) and instructor caring ($r=0.544, p<0.000$) are significantly correlated with instructor goal mastery structure; and instructor caring ($r=0.679, p<0.000$) is significantly correlated with instructor challenge. Mathematics efficacy ($r=0.236, p<0.028$) and grade achieved ($r=0.286, p<0.007$) are significantly correlated with grade expected. Mathematics efficacy ($r=0.214, 046$), instructor goal mastery structure ($r=0.319, p<0.002$) and instructor challenge ($r=0.314, p<0.003$) are significantly correlated with grade achieved.

For males, instructor challenge ($r=0.347, p<0.015$), instructor goal mastery structure ($r=0.377, p<0.007$) and instructor caring ($r=0.342, p<0.016$) are significantly correlated with mathematics efficacy; instructor challenge ($r=0.616, p<0.000$) and instructor care ($r=0.471, p<0.001$) are significantly correlated with instructor goal mastery structure; and instructor care ($r=0.665, p<0.000$) is significantly correlated with instructor challenge. Grade achieved ($r=0.534, p<0.000$) is significantly correlate with grade expected.

For females, there are no significant correlations with mathematics efficacy. However, instructor challenge ($r=0.648, p<0.000$) and instructor care ($r=0.652, p<0.000$) are significantly correlated with instructor goal mastery structure; instructor care ($r=0.696, p<0.000$) is significantly correlated with instructor challenge. Mathematics self-efficacy ($r=0.384, p<0.017$) is significantly correlated with grade expected. Instructor challenge ($r=0.356, p<0.028$) is significantly correlated with grade achieved.

Conclusions

The study confirmed that a positive correlation between self-efficacy and academic achievement existed as found by Fettahloglu, Güven, İnce, Sert and Aydogdu (2011) and Komarraju and Nadler (2013) in their respective studies. Therefore, if students had a positive mathematics self-efficacy it is likely that they will perform better in mathematics. Similarly, there was a positive correlation between mathematics self-efficacy and mastery goal structure, instructor challenge and instructor care as found by Fast, et al. (2010) in their study when they compared the same constructs. Further, the study suggested that student instructor relationships in the form of these constructs influenced their mathematics efficacy. The findings of the studies by Murdock, Hale and Weber (2001), Nolen (2003) and Wolters, 2004 were also confirmed in this study.

In particular, mathematics self-efficacy was positively correlated
with grade expectation and grade achievement despite the grades expected being substantially higher than the actual grades achieved. For females there was no correlation between mathematics self-efficacy and grade achieved. There was, however, a correlation between mathematics self-efficacy and grade expected. For males there was a correlation between mathematics self-efficacy and grade achieved.

The findings of this study suggest that if instructors focus on creating learning classroom environments for mathematics through goal setting, appropriate challenges and empathy student achievement in mathematics will improve. Instructor care was the construct that students least agreed with indicative of the opportunity for instructors to improve their relationships with their students characterized by warmth, friendliness, respect, empathy and care. In so doing it is likely that the student mathematics self-efficacy will improve commensurately with improved achievement the outcome.

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An Exploratory Study of the Health and Safety Induction Practices on a Major Construction Site in South Africa

Ephraim Zulu (ephraimzulu2000@yahoo.co.uk) and Theodore C Haupt (haupt@ukzn.ac.za)

School of Engineering, Property Development Department, University of Kwa-Zulu Natal, Howard College, Durban 4001, South Africa
(Tel.: +27 312602719, Cell: +26 38738739)

School of Engineering, Property Development Department, University of Kwa-Zulu Natal, Howard College, Durban 4001, South Africa
(Tel.: +27 312602712, Cell: +27 826863457)

ABSTRACT AND KEYWORDS
Purpose of this paper
The paper explores the H&S induction practices at a major construction project with the view to identify some of the practices which lead to a good health and safety (H&S) record on a construction site.

Design/methodology/approach
An analysis of documents and a questionnaire survey approach were used to establish the H&S record and the induction practices which contributed to the H&S record on a purposively selected major construction site in Durban, KwaZulu-Natal. The documents analysed were a Monthly H&S Report, minutes of an H&S Committee meeting, and a Legal Compliance Audit Report. The questionnaire was based on good H&S induction practices, design and content identified from literature. Descriptive statistics were computed to summarise the responses using the statistical package for social sciences.

Findings
The selected construction site had a notable H&S record which even won a regional Master Builders Association (MBA) safety compliance award. The H&S induction practices were all in tandem with accepted best practice as defined by reviewed literature. The induction programme was well designed, the content complied with accepted practice, the general H&S
practices were good and the management and leadership of the project were committed to the H&S programme. All this yielded a very noteworthy H&S site record.

**Research limitations/implications**

The study is limited by the fact that only one purposively selected construction site was surveyed and the number of respondents was small. Also, only documents for one month were analysed.

**Practical implications (if applicable)**

Construction projects that want a good H&S record should appropriately design their H&S induction programme and content and enforce the good H&S practices with the site management and leadership maintaining commitment to the H&S programme.

**What is original/value of paper.** The paper is of value to construction H&S practitioners who are interested in maintaining a good H&S record.

**Keywords:** Health and safety, Health and safety induction, Induction practices.

**1. INTRODUCTION**

The construction industry is one of the most dangerous industries in terms of occupational Health and Safety (H&S) (Sousa et al., 2014; Mahmoudi et al., 2014). This record is exacerbated by the tendency of construction companies to place more emphasis on time, cost and quality over the H&S performance of the company (Smallwood, 2015). The management of H&S risk at project level on construction sites is cardinal for improving the H&S record of construction companies (Mahmoudi et al., 2014). H&S management is conducted within the framework of Health and Safety Management Systems (HSMS). The Institute for Work and Health (IWH, 2016) defines HSMS as “the integrated set of organizational elements involved in a continuous cycle of planning, implementation, evaluation and continual improvement, directed toward the abatement of occupational hazards in the workplace”. Within the framework of an HSMS, Smallwood (2015) recommended that worker participation and H&S education and induction training are important predictors of the H&S performance of a company.

Induction training is one of the parts of an effective construction HSMS, albeit a very small piece. Notwithstanding that H&S induction training occupies a very small piece of the HSMS, its contribution to the success of a HSMS and engendering a culture of H&S in the workers on a construction site is unquestionable. H&S induction is very important for achieving a safe working environment because even the best laid H&S plans cannot be effective unless they are communicated to the workers who will actually face the hazards. This exploratory study therefore investigates the induction H&S practices on a major construction site. The
selected site is the proposed Dr. Pixley Ka Isaka Seme Hospital located in Durban along Bhejane Road in KwaMashu. The construction site covers an area of about 100m x 300m with 10 blocks of 5 storeys each which will house 111 medical/surgical in-patient beds, 14 paediatric beds, 20 intensive care beds, 10 high care beds, 20 day beds, 4 general theatres, 1 dental theatre, 2 specialised theatres, 1 obstetric theatre and 2 minor theatres. The project construction cost is over R2 Billion. The project commenced construction in January 2015 and is scheduled for completion in November 2018. The safety record so far is notably good with over 1 million hours without a fatality and only 4 near misses classified as significant near misses. Given this notable H&S record, this study attempts to highlight the H&S induction practices which contributed to achieving the record.

2. HEALTH AND SAFETY INDUCTION

In order to promote a good safety culture on construction sites, several initiatives are necessary including conducting H&S induction training to workers before they gain access to a construction site (Choudhry et al., 2007; Loosemore and Andonakis, 2007). Induction training has been effectively used to train workers on H&S risks and how to manage these on different types and sizes of projects. For example on the Channel Tunnel project, among other interventions, the main contractor carried out inductions for all the workers including those of the sub-contractors (Bust et al., 2008). Workers who had difficulties were given a one-on-one induction. Makin and Winder (2008) cited induction training for both workers and visitors as a key component of a framework to improve the application occupational H&S management systems.

H&S induction training involves familiarising site workers with the site specific H&S hazards which are likely to be encountered while working on the site so that they may conduct themselves in a manner which does not endanger themselves or anyone else (Godfauurd and Abdulkadir, 2011; Vecchio-Sadus and Griffiths, 2004). H&S inductions training is also done to ensure that workers understand their H&S responsibilities (Bust et al., 2008). It can also be used to communicate results of risk analyses which were done to identify H&S risks on the construction site (Vassie and Lucas, 2001).

For H&S induction training to be meaningful and appreciated, it must address issues that address the specific hazards the workers will encounter constantly on the work site (Safe-Work-Australia, 2014; Site-Safe-Scotland, 2005). The content should therefore include and stress task specific and current hazards rather than generic hazards which the workers often feel they are familiar with such as site rules, site specific hazards, risks to employees performing their jobs and procedures for reporting incidences and injuries (Vecchio-Sadus and Griffiths, 2004; Whitaker et al., 2003).

The language of instruction during an induction session is an important consideration in induction design (Bust et al., 2008). Trajkovski...
and Loosemore (2006) found questionable benefits of the mandatory H&S induction programme conducted in English and used on migrant workers who were not proficient in the English language. Trajkovski and Loosemore (2006) and Vecchio-Sadus and Griffiths (2004) suggested conducting induction training in a variety of languages and translating induction training material into a variety of languages coupled with sensitivity to cultural needs.

While H&S induction training is used extensively globally, it is governed differently in different countries. For example, in Australia, H&S induction training is mandatory and there are generally three types of induction training conducted, namely, general H&S training, work activity H&S training and site specific H&S training (Loosemore and Andonakis, 2007). General OHS training is meant to give workers basic H&S principles while work activity training is designed to provide trade specific H&S training and site specific H&S training aims to give workers H&S training specific to a construction site (Ibid). Each of the specific types of induction training is important to provide a well-rounded H&S training to deal with all the construction hazards which may be encountered on a construction site. It is important to cover H&S training at all the levels outlined since H&S hazards can fall under any one of them. For example, at the trade level, Mayhew et al. (1997) found that job specific hazards and risk exposures were the major determinant of patterns of work related injuries in four industries.

Despite the existence of a legislatively mandatory construction induction training in Australia, Dingsdag et al. (2008) bemoaned the absence of a standardised OH&S training. The lack of uniformity in the induction training programmes has been advanced as a reason why some very few companies have performed better than others. It is envisaged that a well-developed and standardised H&S induction programme would provide the all workers with the best practice. Another argument against site specific H&S induction training is that workers receive different messages when they change projects or contracting companies (Bust et al., 2008). However, others argue that H&S induction training should be site specific rather than standardised since hazards are always site specific. Workers, on the other hand, often argue that the difference between sites if marginal and so the workers feel that they are already familiar with H&S matters (Godfaurd and Abdulkadir, 2011). However, Godfaurd and Abdulkadir (2011) further argued that familiarity breeds contempt and that the workers need site H&S induction to remind them about the potential hazards and make them more safety cautious especially in terms of site hazard perception. Nevertheless, it was also reported that even when site H&S induction training is conducted, workers sometimes find it to be of low value (Loosemore and Andonakis, 2007).

Choudhry and Fang (2008) found that workers engage in unsafe behaviour because of lack of H&S awareness, to exhibit being ‘tough guys’, work pressure, co-worker attitudes, and other organisational, economic and psychological factors. Management and leadership involvement and commitment to the H&S programme of the organisation, H&S education and H&S orientation and induction were advanced as one of the necessary
and important interventions to curb some of the reasons why workers engage in unsafe H&S work behaviours.

Management attitude to the H&S programme has a significant influence on the workers attitude to H&S as well (Choudhry and Fang, 2008). The participation of management and leadership at all levels of an organisation is important to the success of the H&S programme of the organisation (CIDB, 2009). Choudhry and Fang (2008) found that the involvement and commitment of management to the H&S programme and toolbox talks were some of the most significant initiatives for encouraging and facilitating good H&S practices. Management commitment to the H&S programme is important especially that time, cost and quality are marginally more important to organisations than H&S performance (Smallwood, 2015).

3. RESEARCH APPROACH

The study is based on a document analysis and questionnaire survey administered to a convenient sample of 18 workers at the construction site of Dr. Pixley Ka Isaka Seme Hospital in Durban, KwaZulu-Natal. The construction site was purposively selected based on proximity and ease of access due to previous other associations with the construction site. The survey approach was favoured because the study was exploratory in nature with the view of understanding the H&S induction practices at the project.

The documents analysed were a Monthly H&S Report, minutes of an H&S Committee meeting, and a Legal Compliance Audit Report which were used to establish the H&S record of the site and also note some H&S practices observed on site. The questionnaire was used to solicit the level of agreement of respondents on some H&S induction practices using a five point Likert scale with 1 = “Strongly Disagree”, 2 = “Disagree”, 3 = “Neutral”, 4 = “Agree” and 5 = “Strongly Agree”. The questionnaire covered general inductions design, H&S induction content, H&S induction practices and organisational commitment to the H&S programme. The specific questions included can be seen in the analysis tables under each section.

4. FINDINGS AND ANALYSIS

4.1 Questionnaire Survey

4.1.1 General H&S Induction Design

The general design of the H&S induction adheres to recommended practice like recommendations by (Safe-Work-Australia, 2014) and (Site-Safe-Scotland, 2005) among others. The average scores from each of the items was above 4 (shown in Table 4.1) meaning that respondents agree that the induction design is good.
### Table 4.1 H&S Induction Design

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Induction location is quiet and</td>
<td>4.39</td>
<td>0.61</td>
</tr>
<tr>
<td>without distractions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The induction is done at an easy</td>
<td>4.22</td>
<td>0.81</td>
</tr>
<tr>
<td>pace</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Everything that is said can be</td>
<td>4.22</td>
<td>0.65</td>
</tr>
<tr>
<td>heard clearly</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A record of all attendees is kept</td>
<td>4.33</td>
<td>0.69</td>
</tr>
<tr>
<td>The induction is site-specific to</td>
<td>4.22</td>
<td>0.65</td>
</tr>
<tr>
<td>this site and provides</td>
<td></td>
<td></td>
</tr>
<tr>
<td>information on the current</td>
<td></td>
<td></td>
</tr>
<tr>
<td>hazards of the site and</td>
<td></td>
<td></td>
</tr>
<tr>
<td>the site rules</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Induction requires that everyone</td>
<td>4.28</td>
<td>0.75</td>
</tr>
<tr>
<td>signs in and out of the site to</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ensure that there is a record of</td>
<td></td>
<td></td>
</tr>
<tr>
<td>everyone on the site for security</td>
<td></td>
<td></td>
</tr>
<tr>
<td>and emergency purposes</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 4.1.2 H&S Induction Content

From a sample of the generally required content in an H&S induction, Table 4.2 shows that on average, the relevant items were covered in the H&S induction. The site conducts induction with the content as recommended by among others, Safe-Work-Australia (2014), Site-Safe-Scotland (2005), Vecchio-Sadus and Griffiths (2004) and Whitaker *et al.* (2003).

### Table 4.2 H&S Induction Content

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Induction includes site-specific</td>
<td>4.33</td>
<td>0.59</td>
</tr>
<tr>
<td>elements appropriate to work</td>
<td></td>
<td></td>
</tr>
<tr>
<td>activities and/or site wide</td>
<td></td>
<td></td>
</tr>
<tr>
<td>hazards</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Induction includes identifying</td>
<td>4.18</td>
<td>0.73</td>
</tr>
<tr>
<td>where all facilities are</td>
<td></td>
<td></td>
</tr>
<tr>
<td>such as toilets and first aid</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Induction stresses the importance</td>
<td>4.22</td>
<td>0.55</td>
</tr>
<tr>
<td>of good housekeeping to prevent</td>
<td></td>
<td></td>
</tr>
<tr>
<td>slips, trips and falls</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Induction covers waste management</td>
<td>4.11</td>
<td>0.68</td>
</tr>
<tr>
<td>requirements such as location of</td>
<td></td>
<td></td>
</tr>
<tr>
<td>skips and disposal requirements</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Induction covers environmental</td>
<td>4.28</td>
<td>0.57</td>
</tr>
<tr>
<td>issues such as chemicals, smoke,</td>
<td></td>
<td></td>
</tr>
<tr>
<td>noise or wildlife</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Induction covers the types of</td>
<td>4.29</td>
<td>0.59</td>
</tr>
<tr>
<td>signage and the use of various</td>
<td></td>
<td></td>
</tr>
<tr>
<td>colours and their importance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Induction covers the use of radios</td>
<td>4.28</td>
<td>0.75</td>
</tr>
<tr>
<td>and mobile phones</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Induction covers working at heights</td>
<td>4.50</td>
<td>0.51</td>
</tr>
<tr>
<td>Induction covers the correct</td>
<td>4.33</td>
<td>0.59</td>
</tr>
<tr>
<td>erection, use and dismantling of</td>
<td></td>
<td></td>
</tr>
<tr>
<td>scaffolding</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Induction covers manual handling</td>
<td>4.35</td>
<td>0.49</td>
</tr>
<tr>
<td>Induction includes a traffic</td>
<td>4.22</td>
<td>0.55</td>
</tr>
<tr>
<td>management plan</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Induction covers Hand Arm Vibration Syndrome (HAVS) and Vibration White Finger (VWF) caused by excessive use of vibrating tools such as breakers and drills.

<table>
<thead>
<tr>
<th>4.1.3 H&amp;S Induction Practices</th>
</tr>
</thead>
<tbody>
<tr>
<td>The H&amp;S induction practices are in tandem with recommended practices as suggested by Makin and Winder (2008), Bust et al. (2008), Loosemore and Andonakis (2007) and Choudhry et al. (2007). Their appears to be a strict emphasis on alcohol with the two items dealing with alcohol consistently scoring close to strongly agree with the smallest standard deviation among all the items. This can be seen in Table 4.3.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 4.3 H&amp;S Induction Practices</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td>Certain areas of work require specific authorization to proceed such as a Permit to Work</td>
</tr>
<tr>
<td>Material that could fuel fires is removed</td>
</tr>
<tr>
<td>No liquid waste such as paints and solvents are allowed to soak into the ground or poured down drains</td>
</tr>
<tr>
<td>No bonfires are allowed on site</td>
</tr>
<tr>
<td>No food or drink is to be taken on site</td>
</tr>
<tr>
<td>Labels on containers must always be read before use</td>
</tr>
<tr>
<td>No alcohol is to be consumed on site</td>
</tr>
<tr>
<td>No one under the influence of alcohol or other substance is allowed on site</td>
</tr>
<tr>
<td>Anyone on medication that might impair their performance must inform their supervisor</td>
</tr>
<tr>
<td>Horseplay is strictly forbidden</td>
</tr>
<tr>
<td>Only persons trained and authorized to use plant and equipment are allowed to use them</td>
</tr>
<tr>
<td>Equipment must be fit for use and inspected regularly</td>
</tr>
<tr>
<td>Where the risk assessment requires the use of fall arrest equipment it must be used in accordance with a safe system of work including emergency rescue procedures</td>
</tr>
<tr>
<td>Ladders and stepladders must be located on a firm level base and only used for short duration light duty</td>
</tr>
<tr>
<td>Only trained and authorised personnel are allowed to operate driver operated plant such as dump trucks</td>
</tr>
<tr>
<td>Identified walkways are provided</td>
</tr>
<tr>
<td>Any on-site accidents or dangerous occurrence must be reported to the supervisor</td>
</tr>
</tbody>
</table>
4.1.4 Organisational Commitment to H&S Programme

The organisation is committed to the H&S programme with the mean responses for all the items under this section falling above the agree level (see Table 4.4). The H&S record of the site so far and the good H&S practices found also point to the commitment of management to ensuring a sound H&S environment on site since management commitment has also been reported elsewhere as having a significant impact on the H&S practices on site (Choudhry and Fang, 2008; Smallwood, 2015).

Table 4.4 Organisational Commitment to H&S

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>The commitment of the company to health and safety is stressed</td>
<td>4.39</td>
<td>0.61</td>
</tr>
<tr>
<td>The health and safety policy is explained</td>
<td>4.22</td>
<td>0.55</td>
</tr>
<tr>
<td>The company is committed to protecting the health and safety of</td>
<td>4.61</td>
<td>0.50</td>
</tr>
<tr>
<td>everyone working at or visiting the site</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The company plans, manages, conducts and supervises all work on</td>
<td>4.33</td>
<td>0.69</td>
</tr>
<tr>
<td>site in compliance with legislation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The company plans, manages, conducts and supervises all work on</td>
<td>4.28</td>
<td>0.67</td>
</tr>
<tr>
<td>site in compliance with better practice</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

4.2 Document Analysis

Three H&S documents were analysed to establish the H&S record/environment of the site and also identify some of the H&S practices other than induction which augment the induction practices in achieving the safety record/environment. The documents analysed are the Monthly H&S Report for June 2016, the H&S Committee Meeting Minutes for the month ended June 2016 and the H&S Legal Compliance Audit Report for June 2016. The documents were selected conveniently because they were the latest set of documents and while they did not show previous trends, they reported the cumulative H&S statistics.

4.2.1 Monthly H&S Report – June 2016

Table 4.5 June H&S Statistics

| Total Employees | 722 |
| Total Man Hours worked | 149,183 |
| Total Number of Supervisors | 66 |
| Total Number of Safety Officers | 23 |

The statistics in Table 4.5 are from 23 different contractors including the main contractor and all sub-contractors. Each company had its own safety
officers some of whom were on site on a part-time basis. The ratio of the safety officers to the total number of employees for the month of June is at 1 to 32. The South African construction industry generally but informally recommends 1 safety practitioner per 50 workers as a minimum depending on the risk assessment of the site (Furter, 2012). The ratio maintained at the study site is far better than the recommended minimum and the use of H&S officers on a part-time basis for small numbers of workers is also recommended (Ibid). The part-time H&S staff were used by subcontractors with few workers on site consistent with recommended best practice.

The monthly H&E report also reported the project incident/injury summary for the month of June and also for the whole project cumulatively. For both the month and project statistics, there were no fatalities, lost workdays nor lost time injuries. Table 4.6 shows the remaining statistics for the month and the whole project. From the statistics, there is 1 recordable first aid case for every 43 workers and 1 near miss for every 10 workers for the month of June. Expressed as percentage, this translates into a 2.3% chance of worker encountering a recordable first aid case and a 10% chance of a worker encountering a near miss. Without recommended similar statistics to compare with, it is difficult to say whether the statistics are favourable. Nevertheless, a 2.3% chance of being injured appears fairly reasonable while a 10% chance of a near miss appears fairly high. The previous month had a total of 125 near misses. The total number of workers on site for that month was not collected with the other statistics. Therefore, for the sake of comparison, using the June number of workers on site and the May statistic for near misses gives a ratio of 1 near miss for every 6 workers which translates into a 17% chance of a worker encountering a near miss.

<table>
<thead>
<tr>
<th>Incidences</th>
<th>This Month</th>
<th>Project Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Recordable First Aid Cases</td>
<td>17</td>
<td>140</td>
</tr>
<tr>
<td>A1 Total Recordable Medical Cases</td>
<td>01</td>
<td>13</td>
</tr>
<tr>
<td>Near Misses</td>
<td>75</td>
<td>1121</td>
</tr>
<tr>
<td>Significant near misses</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>A2 Total Recordable LTI Cases</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Hours Worked</td>
<td>149 183</td>
<td>1 489 057</td>
</tr>
<tr>
<td>Total days worked without a recordable LTI case</td>
<td>484</td>
<td>Achieved previous target 400 New target 600</td>
</tr>
<tr>
<td>Total hours worked without a recordable LTI case</td>
<td>1 489 057</td>
<td>Achieved 1 Million LTI Free man hours New target 2 Million LTI Free man hours</td>
</tr>
</tbody>
</table>

*LTI – Lost Time Injury*
4.2.2  H&S Committee Meeting Minutes – June 2016

There were 30 members of the committee present at the meeting with 4 apologies received. Among the present members were 2 project managers. Among the apologies were only one member who could be classified as management and this was a site agent. The fact that the senior members of the management in the committee attended the meeting when they could have given apologies to attend to other pressing matter is testament of the commitment of management to the H&S agenda. This is consistent with the findings from the questionnaire survey.

The meeting was informed that the project had won the regional MBA safety compliance award in the category of projects with contract value greater than R500m. The impressive H&S record so far attained and attributable to the good H&S general practices is easily recognisable.

The meeting also noted that there was a trend of hand injuries. First aid injuries were found to be predominantly hand related injuries. As a measure against the trend, the meeting resolved to advise, train and enforce safe working with hands on site. This was detailed in the focus areas for the following month. The committee recognises the value of H&S education and communicating predominant risk and hazards and how the workers can deal with these.

The meeting also noted the decrease in the number of near misses reported from 125 the previous month to 75. This was attributed to poor reporting practices rather than an actual decline in near misses. The importance of reporting near misses was stressed as indicative of negligent behaviour which should be monitored and so the importance of reporting near misses.

Other unsafe acts were noted including working at height without safety harnesses, not using gloves, goggles and dust masks when the situation demands. Unsafe condition noted included some areas lacking edge protection and poor housekeeping in some areas.

4.2.3  H&E Legal Compliance Audit Report – June 2016

The legal compliance audit is based on the OHS ACT, 85 of 1993, Construction Regulations and other OHSACT Regulations. The audit found the project 92% compliant. The audit scores each of the items using four colours, namely grey, yellow, green and red. Grey is used for compliance below 50%, yellow for reasonable compliance which is greater than 50%, green for full or 100% compliance and red for none compliance.

Items graded green were 34, those grade yellow were 11 and only two were graded grey while no items were graded red. While the report shows two items graded yellow, they refer to the same concern which was that 5 workers were observed not wearing gloves and one worker had on a torn boot. The issue of workers not wearing gloves has been highlighted both the previous reports and measures have already been suggested to handle the trend.
7. CONCLUSIONS

The H&S record at the Dr. Pixley Ka Isaka Seme Hospital in Durban, KwaZulu-Natal is very good. So good in fact it was awarded the regional MBA safety compliance award. The site has gone for over one million hours without a fatality and only four near misses classified as significant near misses.

The notable H&S record can be generally attributed to the good H&S practices and the subsequent H&S environment created on site by the H&S practices observed. The H&S practitioner to worker ratio of 1 to 32, the good induction programme and the commitment to enforcement of good H&S practices are some of the notable practices at the site which combine to create a favourable H&S environment. Therefore, a good H&S induction programme is a major contributor to a safe work environment and a good construction site H&S record. The H&S induction design, content, practices and management commitment are very well conducted and in tandem with accepted H&S induction practice. The benefits of the good practices can be seen in the notable H&S record of the project.

The leadership and management of the project are committed to H&S programme which is commendable against the backdrop of pressure to be more profit oriented. The commitment can be seen both from the survey results and from the documents analysis were it can be seen that senior management actually take a keen and active interest in the H&S programme. The management commitment has a knock on effect with the H&S personnel also maintaining commitment and subsequently the workers taking not just the H&S induction programme but also the entire H&S programme seriously.

8. ACKNOWLEDGEMENT

The authors would like to acknowledge the contribution of Mr M.S. Mahole who helped with data collection.

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ASOCSA2016-047

Assessing Safety Performance of Construction Workers in Gauteng, South Africa

Chioma Sylvia Okoro¹, Innocent Musonda² and Justus Agumba³
¹,²,³School of Civil Engineering and the Built Environment
Department of Construction Management and Quantity Surveying
University of Johannesburg, South Africa

Abstract

Purpose of this paper
The health and safety (H&S) of construction workers has been a subject of much deliberation and justifiably so, since construction workers are invaluable in construction processes. The paper presents findings on an assessment of safety performance of construction workers in the Gauteng province of South Africa.

Methodology
A field questionnaire survey was conducted to collect data regarding safety performance on sites. Participants were selected using heterogeneity and convenience sampling techniques. Data were analysed using Statistical Package for the Social Sciences, version 22 software. Mean values and standard deviation were computed.

Findings
The results of the study indicated that medical treatment beyond on-site first aid and limited work days were minimal among the participants. It was also found that poorer safety performance with regard to risk assessment before engaging in tasks and accepting any kind of work prevailed.

Value
The current paper identifies potential areas for improvement in construction workers’ safety performance. Construction employers and stakeholders would be enabled to develop measures to check the identified safety indicators and behaviours among their workers.

Keywords: construction workers, safety performance, South Africa
1. INTRODUCTION

The construction industry contributes immensely to the development of many economies. The sector accounts for about 10% of the global gross domestic product (GDP), 7 – 10% of the GDP in developed economies and 3 – 6% in underdeveloped economies (Murie, 2007; Giang & Pheng, 2011; Osei, 2013). It contributes about 4% to the GDP of South Africa (Statistics South Africa, 2014). Not only is the industry a great contributor to GDP, but it is also the second largest employer worldwide (after agriculture) (WIEGO, 2014), accounting for 7% of global employment, approximately 180 million construction workers worldwide (Murie, 2007; WIEGO, 2014), which is 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 provides much needed employment for many of the world’s poorest and most vulnerable people (WIEGO, 2014) and by so doing, alleviates poverty and improves living standards.

However, despite the undeniable contribution of the sector, its safety performance continues to be a source of concern. This is in spite of government efforts to deal with the problem in the form of legislations and regulations (Murie, 2007; Agumba, 2013). Proper attention to workers’ health and safety is beneficial and crucial since construction workers, especially craft workers (who are the focus in this study) are important human resources involved in the actual construction activities. Hence, more consideration should be given to the subject since injuries and fatalities can be reduced, employability of workers can be improved and productivity increased. Assessing safety performance of construction workers is an important consideration for improving H&S performance in the industry (Huang et al., 2013).

Attention has been given to construction worker safety performance and behaviours, for instance, Melia & Becerril (2009) who studied unhealthy behaviour of workers outside the work environment; Fugar et al. (2010) who focused on ways to improve safety behaviour; and Lipscomb et al. (2015) who explored perceptions of carpenters about reporting work injuries only. It appears that little literature has been devoted to actual safety performance and behaviours of the workers on worksites which contribute to the reported poor safety performance records, especially in South Africa. The objective of the present study is to evaluate safety performance of workers on construction sites in the Gauteng province of South Africa. Information on workers’ safety behaviour would aid in identifying potential areas of improvement, which will inform subsequent development of strategies to stimulate proactive behaviours, and thus reduce the risk and occurrence of accidents on construction sites.
Stimulating healthy behaviour is essential to achieve safe workplaces (Melia and Becerril, 2009; Fugar et al., 2010).

2. REVIEW

2.1 Construction health and safety performance

Attention has been given to occupational accidents in many countries for over 100 years (Hamalainen et al., 2009; Cameron & Duff, 2007). Although a decline in the number of fatal injuries in recent years has been indicated, statistics still report unacceptably high rates of accidents, injuries and fatalities (Cameron & Duff, 2007; BLS, 2013; Health and Safety Executive (HSE), 2014). Compared to other industries, the construction industry has the highest rates of fatalities and injuries, being responsible for 30 to 40% percent of world’s fatal injuries (Murie, 2007; Construction Industry Development Board (CIDB), 2009). According to the International Labour Organisation (ILO), one in every six work-related fatal accidents occurs on a construction site (CIDB, 2009).

In Britain, the construction industry accounts for 27% of fatal injuries and 10% of reported major injuries (HSE, 2013). Provisional statistics from the HSE revealed indicated that there were 46 fatal injuries in construction in Britain, approximately 12% of total fatal injuries to both workers and passers-by (HSE, 2014). In the United States of America (USA), the sector accounted for approximately 18% of total fatal work injuries in 2012, having recorded a total of 775 fatal injuries (Bureau of Labour Statistics (BLS), 2013). In South Africa, the situation is no different. The building and construction sector is one of the high risk sectors. According to Emuze and Smallwood (2013), construction motor vehicle accidents alone were 984 in 2010 and 892 in 2011. Construction related fatalities total about 150 a year and the industry suffers about 400 accidents a year (Prinsloo, 2013).

It is notable that construction H&S performance is universally poor, even in industrialized countries. The status quo established from even unreliable statistics of accidents is unacceptable, specifically with the South African construction industry which has seen an increase in accidents in recent years (Musonda, 2012). There is a collective need to improve H&S performance in order to benefit all and sundry. Effective improvement strategies therefore need to be identified if the status quo is to be positively altered, especially since accidents cost human lives and incalculably
devastating economic effects. The economy, employers and insurance companies not only face directly related accident costs (such as medical, hospital and rehabilitation expenses, workers compensation payments, and higher insurance premiums or even loss of insurability), but also long-term follow-up costs (for instance, loss in wages, loss of morale, legal costs, training costs, loss of skill/efficiency, administrative time, costs to repair damaged property) which are less obvious and usually greater than direct costs (Thepaksorn & Pongpanich, 2014).

2.2 Measures of health and safety performance

Traditionally, safety performance has been measured by such metrics as the Occupational Health and Safety Administration (OSHA) record of accidents, injury and ill-health statistics (HSE, 2001; Hinze et al., 2013). However, it has been argued that measuring H&S performance by the frequency of accidents and injuries is not always appropriate (HSE, 2001). This is particularly true in settings where there is a low probability of accidents but where major hazards are present, such as construction worksites (HSE, 2001). Moreover, gross under-reporting of accident and injury statistics renders such historical records unreliable and deceptive as indicators of safety performance. In some organizations, under-reporting occurs probably because health rates as a measure, particularly when related to reward systems, can lead to such events not being reported so as to ‘maintain’ performance (HSE, 2001). Therefore, injury rates often do not reflect the potential severity of an event, merely the consequence; they reflect outcomes, not causes (HSE, 2001). This implies that some indicators may be trailing (also called lagging indicators), providing data about incidents after the fact (Hinze et al., 2013), whereas others may be prevailing (called leading indicators), potentially leading to an injury or incident (Biggs et al., 2009). Both leading and lagging indicators reflect safety performance (Hinze et al., 2013; Lingard et al., 2013).

Therefore, in addition to accidents, injuries and ill-health statistics, other safety performance indicators which are related to worker safety performance have been identified from various studies, although these studies dwelt heavily on safety management systems. These identified worker safety performance indicators include the following:

- Use of correct personal protective equipment (PPE) (Biggs et al., 2009; Construction Industry Institute (CII), 2014).
- Risk assessment. Identification of the tasks, hazards and the risks of a job prior to work enables implementation of protective measures to ensure that work is done safely (Campbell Institute, 2014).
- Number of reported incidents/reporting of incidents or close-calls (Hinze et al., 2013; Campbell Institute, 2014).
Medical treatment beyond first aid (Biggs et al., 2009; International Council on Mining and Metals (ICMM), 2014). First aid involves a particular level of treatment (such as cleaning and covering of wounds, use of non-prescription medication, etc.; whereas medical treatment occurs when an injury or disease requires a higher degree of care and management to ensure a full recovery, for instance, treatment of fractures, suturing of wounds and prescribing and providing drugs to manage symptoms (ICMM, 2014).

Restricted activity days. Loss of working capacity or inability to perform normal or routine work functions on the next calendar day after an injury reflects poor worker safety performance (ILO, 2003).

Lost work days. Absence from work due to an injury, for more than three consecutive working days is considered serious and compensable (ILO, 2003; Cameron & Duff, 2007).

Non-injury incidents or near-misses (Biggs et al., 2009; Hinze et al., 2013; CII, 2014).

According to Atkins (2011), the use of a set of safety performance indicators provides a greater indication of safety performance than concentrating on one measure in isolation (or indeed a small number of random measures). Good safety performance indicators should be quantifiable and permit statistical inferential procedures and should be valid and representative of what is to be measured (Roelen and Klompstra, 2012).

The interpretations are related to the system and its operational context (Herrera, 2012). The above-mentioned indicators relate to construction workers, prior to or after an incident, and were therefore adopted as measures of worker safety performance, in the current study.

3. METHODS

After an extensive survey of literature related to H&S performance in the construction industry, a 5-likert scale questionnaire was developed. Safety performance measures were adapted from existing studies (as reviewed above). The questionnaire contained questions enquiring about safety performance on construction sites. The identified items related specifically to those measures which could be associated with unhealthy eating, since this was the purpose of the main study. The questionnaire, which consisted of 10 items, was pilot-tested, reviewed and revised by experts before being self-administered to construction workers on construction sites. The participants, selected through heterogeneity and convenience sampling, included workers who were actively engaged in the physical construction
activities as opposed to the site managers and supervisors. This group was chosen as they were the most susceptible to poor safety performance on construction sites. Purposive sampling is based entirely on the judgment of the researcher and there is greater chance of personal bias, which could however, give good results if done with care (Fugar et al., 2010).

Out of a total of 220 questionnaires distributed, 183 were returned and used for the empirical analysis. Cronbach’s alpha was used to assess the internal consistency reliability of the scale. The alpha index was 0.83, indicating good internal reliability (Pallant, 2013). The questionnaire was considered to be reliable and representative of what is to be measured (Roelen and Klompstra, 2012). The response categories were assigned 1, 2, 3, 4 and 5, for “on every project”, “more than two times”, “two times”, “once before” and “never”, respectively. Therefore, higher scores represent a higher safety performance. Mean (M) and standard deviation (SD) values were computed for the variables.

4. RESULTS AND DISCUSSION

Respondents were asked to indicate the extent to which statements regarding their safety performance on construction sites related to them. From the table, it can be seen that 78% of the participants had never been treated medically for injuries (beyond first aid on site) (M=4.63, SD=1.262) or been asked to do limited work after an injury(M=4.60, SD=1.418), respectively. With their highest recorded Ms, it can be deemed that medical treatment and limited work days were minimal among the participants, since higher scores represent better safety performance (as stated earlier). On other hand, failure to wear PPE (M=4.24, S=0.972), failure to consider possible risks in a task (risk assessment) (M=4.05, S=0.871), and accepting any kind of work, not minding the risk involved (M=3.69, S=0.951) recorded the lowest Ms, suggesting poorer safety performance.

Although a good percentage (67%) of the participants reported that they never failed to wear PPE, 33% reported otherwise. A possible explanation for the 33% responses could be that the workers felt uncomfortable wearing PPE while working. This view was articulated in Arcury et al. (2014) in which participants believed that wearing PPE made them uncomfortable and hindered their productivity and thus work safety was jeopardized.

It is noteworthy that 19% of the participants accepted any kind of work on every project, irrespective of the risk involved. It can be deemed that the participants in this category have no misgivings about engaging in dangerous tasks as long as they are employed. The construction industry has no difficulty attracting labour even where the wages are very low (ILO, 2001). This further suggests that construction workers are low-paid and
probably have no choice but to take any job even without considering the risks involved, as evinced by the 10% who reported failure to consider possible risks on every project.
Table 1: Findings on safety performance of the study participants

<table>
<thead>
<tr>
<th>Measures</th>
<th>Responses (%)</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>On every project</td>
<td>More than two times</td>
<td>Two times</td>
</tr>
<tr>
<td>Been treated medically for injuries (beyond first aid on site)</td>
<td>2 2 4 14 78</td>
<td>4.63</td>
<td>1.262</td>
</tr>
<tr>
<td>Been asked to do limited work after an injury</td>
<td>1 5 5 12 78</td>
<td>4.60</td>
<td>1.418</td>
</tr>
<tr>
<td>Been involved in incidents or near-misses</td>
<td>2 5 3 16 74</td>
<td>4.53</td>
<td>1.615</td>
</tr>
<tr>
<td>Been away from work for more than three days due to an injury</td>
<td>3 4 6 12 75</td>
<td>4.53</td>
<td>.994</td>
</tr>
<tr>
<td>Failed to report an accident or incident</td>
<td>3 5 4 13 75</td>
<td>4.52</td>
<td>1.048</td>
</tr>
<tr>
<td>Been injured at work</td>
<td>3 6 6 22 63</td>
<td>4.35</td>
<td>1.023</td>
</tr>
<tr>
<td>Been sick at work</td>
<td>2 8 8 25 58</td>
<td>4.29</td>
<td>.843</td>
</tr>
<tr>
<td>Failed to wear personal protective equipment (PPE)</td>
<td>6 9 7 11 67</td>
<td>4.24</td>
<td>.972</td>
</tr>
<tr>
<td>Failed to consider possible risks in a task</td>
<td>10 11 6 11 62</td>
<td>4.05</td>
<td>.871</td>
</tr>
<tr>
<td>Accepted any kind of work, not minding the risk involved</td>
<td>19 9 9 10 53</td>
<td>3.69</td>
<td>.951</td>
</tr>
</tbody>
</table>
It is also notable that the responses were concentrated on the “never” category. This suggests that the respondents can be deemed to have had no incidence with regard to safety performance on construction sites. Such work injury records may either reflect safe work conditions or under-reporting (Lipscomb et al., 2015). Workers may be inclined to conceal incidences for fear of repercussions from management or fellow workers. That 75% of workers “never” failed to report an accident or incident corroborates findings from Lipscomb et al. (ibid.) which reported that the same proportion of the participants felt that they could report work-related injuries without fear of retribution, while some (nearly half) considered it best not to report minor injuries. In many developing countries, many accidents and injuries go unreported (Fugar et al., 2010). Formal and informal policies and practices on jobsites could also influence injury reporting (Fugar et al., ibid. Lipscomb et al., 2015).

5. CONCLUSION

The study set out to assess the safety performance of construction workers. This objective has been met. By identifying aspects of safety workers may be lacking in performance, potential areas for improvement in construction workers’ safety performance have been highlighted. Construction employers and stakeholders would be enabled to develop measures to check the identified safety indicators and behaviours among their workers. Policies (formal and informal) and incentives could be effective in encouraging and motivating construction workers to improve on their safety performance.

The study is not without limitations. Firstly, it includes only participants in one province of South Africa and so the results may not be generalizable. Secondly, the study employed a quantitative approach which does not reveal further information about the reasons for some unsafe behaviours (especially with regard to the leading safety indicators). Therefore, future studies could conduct a more in-depth study using qualitative or mixed methods. More investigation is required to validate or refute the skewed responses (the “never” category). Additionally, future studies could expand the number of workers and explore differences in safety behaviour among different construction trades.

6. REFERENCES


Assessing the Utilisation of Health and Safety plans on Construction Sites in Zambia

Josephine Mutwale¹, Nonde Lushinga² and Lukonde Chilando
E-mail: josephinemutwale@gmail.com
The Copperbelt University, School of Built Environment, Department of Construction Economics and Management, P.O Box 21692, Jambo Drive, Riverside, Kitwe. Tel: +260212225086, Cell: +260977319840

ABSTRACT AND KEYWORDS

Purpose of this paper
This paper advocates for the implementation of the health and safety plans (HSP) on construction sites in Zambia to enhance health and safety for construction workers.

Design/methodology/approach
The research made use of primary and secondary data. Secondary data was obtained from literature available on health and safety practices in Zambia. Primary data was obtained through the use of a questionnaire survey to contractors and consultants.

Findings
The utilisation of the health and safety plan on construction sites in Zambia is poor. Contractors are not compelled or incentivised to use such documents on construction sites and so there is need to make the plan mandatory on construction sites. This can be achieved through amending of regulations and conditions of contract.

Research limitations/implications (if applicable)
The research data was purposively drawn from only two cities in Zambia namely Lusaka and Kitwe for the convenience of economy.

Practical implications (if applicable)
The research was conducted to confirm and give information on the utilisation of health and safety plans on construction sites in Zambia.

Keywords: Health and safety, Construction site, Health and Safety plans, PPE
1. INTRODUCTION

The construction industry is one of the most dangerous industries in terms of occupational safety and health (Sousa et al., 2014). Accidents and injuries are relatively on a higher side due to the nature of the work undertaken, leaving construction workers most vulnerable. Accidents can be attributed to the earning ability of workers and finances for construction participants as a consequence may lead to delays, disputes, impaired company image or loss of market share (Zeng et al., 2007).

The nature and activities of the construction industry are largely labour intensive, fragmented and temporal thereby having a fluctuating nature of job execution. This makes it unattractive for contractors to keep permanent employees and thus they heavily rely on casual labour. Poverty, especially in third world countries like Zambia plays a crucial role in creating desperate individuals who take up jobs at the expense of their own health and safety. Health and safety is a cross-disciplinary concept that is concerned with protecting the safety, health and welfare of people on a construction site (Lingard and Rowlinson, 2005).

According to NCC (2007) the levels of adherence to health and safety regulations by contractors are generally low and alarming, posing a great risk to employees in the construction sector. In the Zambian construction industry costs relating to the health and safety on a construction project are usually inserted by the contractor in the Preliminary and General items in the bill of quantities. The Zambian construction industry adheres to the Occupational Health and Safety Act, 2010, the Workers’ Compensation Act, Chapter 271 (Act No. 10 of 1999) and the Public Health Act, Chapter 295 Act No. 22 of 1995 (ILO, 2012), none of which mandate the use of the health and safety plan.

This paper looks at healthy and safety practices in the Zambian construction Industry and the utilisation of health and safety plans in a bid to improve health and safety practices on construction sites in Zambia.

2. REVIEW OF LITERATURE

2.1 Occupational health and safety

Occupational health services are concerned with the preventive measures laid down to guide the employers, workers and their representatives on the requirements for a safe and healthy working environment. Everyone working must be provided with the personal protective equipment (PPE) and good work environment to include things such as safety attires, safe sanitation and a safe work environment. Kneni (2008) highlights that in their quest to meet their basic needs, workers compromise on their health and safety. Danso (2005) further alludes that
about 65% of construction artisans, especially new entrants do not possess the knowledge of health and safety on a construction site. As a result accidents occur at a substantial rate than in other industries and can have severe consequences on both workers and the general public.

2.2 Factors Contributing to the Occurrence of Accidents

Statistics in Zambia show that an average of 1,200 accidents and diseases are reported to the Workers Compensation Fund Control board annually for the purpose of settling compensation claims in respect of occupational accidents and diseases (Mwila, 2011). There are frequent reports of workers going on strikes or getting injured as a result of poor working conditions (Chitenge et al., 2013). Workers are not provided with essentials such as protective wear, environment and sensitization and prevention of the spread of diseases such as HIV/AIDS is low. The construction industry is particularly vulnerable to the pandemic because of its large unskilled labour force, high labour turnover and the migratory nature of the workforce (Harinarain and Haupt, 2014).

However, data on occupational injuries and diseases is scarce in Zambia and it is therefore difficult for stakeholders (government, employees or employers) to estimate the health and social-economic impacts and target or assess the efficacy of interventions. While data is routinely collected in Zambia through accident notification to the ministry of labour and social security, and worker’s compensation fund control board, there is widespread underreporting of cases (Siziya et al., 2010).

Competitive tendering in construction industry usually leads to submission of low bids by contractors which are accepted at the expense of health and safety standards (Cheng et al., 2004). As a result of the competition, contractors will price low, especially the P&G’s resulting in a lower allocation towards health and safety (Chamanga, 2014). Management commitment also plays a vital role in establishing a work culture that makes health and safety a priority (Priyadarshani, et al., 2013; Cohen 1997 and Shannon 1998). Poor management commitment to health and safety results in negligence (Phillips, 2012).

Other factors contributing to the occurrence of accidents include time pressure, the nature of the works, weather conditions and human error (Cheng et al., 2004; Sotire, 1992; Lucy et al., 1999). Laws and regulation of the land also play an important role in improving overall site well being by imposing on the people responsible. A report by ILO (2005) states that Zambia shows gaps in legislation and designated competencies of authorities. These legislation gaps engender unhealthy work sites; hence the need to study the utilisation of the health and safety plans on construction sites in Zambia, because these plans work as blue prints for accidents and unhealthy practice preventions on a construction site. The underutilisation of the health and safety plans in the Zambian construction
industry has led to the escalation of accidents and poor health conditions of people working on sites.

Contractors in Zambia are not mandated to make a health and safety plan on projects with the exception of USAID funded projects. This is unlike countries such as South Africa which makes provision for this in the South African occupational health and safety Act No. 85 of 1993, has a construction regulation, 2003 (R.1010 of 18/07/2003. Secondly, the ZIA form of contract mainly used for building projects in Zambia has no clause on health and safety plan as a result contractors using this form of contract do not prepare the health and safety plan. According to Mwombeki, (2005) the plan is only submitted upon the request from the client and in the case of the USAID funded projects it is submitted to the projects manager after the awarding of the contract together with the updated programme of works.

2.2 Health and safety Plan

A Health and Safety Plan is a written document that describes the process for identifying the physical and health hazards that could harm workers, procedures to prevent accidents, and steps to take when accidents occur. The written health and safety plan is a blueprint for keeping workers safe. Many organizations compile their activity-specific safety plans into a single safety manual (Business and Legal Resources, 2014).

According to University of Michigan (MU) (2010) a health and safety plan is a document prepared by the contractor in relation to the requirements of the Contract. The document outlines how the contractor intends to address the health and safety issues on the Project to aid in developing a program to eliminate accidents, injuries and property damage. The Plan must also identify foreseeable project-specific hazards and list the construction manager's mitigation and control of such hazards. The Plan is a dynamic document, which contractors are hypothetical to revise it and address any new hazards that were not addressed in the initial Plan but are later identified during the post contract (MU, 2010).

The preparation and use of Health and Safety Plans is a major part of production management of building projects. Health and Safety Plan allows management to formally present its commitment to its employees and to provide concrete strategies to achieve health and safety for all staff (OMEGA, 2003). This is because when the health and safety plan is fully utilised it is the best tool that can be used to manage health and safety on a construction site. This will in turn increase the production on a site as the working environment will be conducive for everyone working on a construction site.

The main aim of Health and Safety Plan is to promote and maintain the highest degree of physical, mental and social wellbeing of construction
workers on site (Dodo et al., 2011). Construction health and safety should deal with both physical and psychological welfare of workers on construction sites and that of third parties. It is an ongoing process that aims to identify and eliminate jobsite hazards throughout the project.

Although the specific elements of each plan will vary by the work or services to be provided and project size, complexity, and location, at a minimum, the plan must adequately address the requirements contained in the document, if applicable to the contractor’s work. The plan must also identify foreseeable project-specific hazards and list the contractor’s mitigation and control measures of such hazards (Ibid).

Countries that use the health and safety plan have it as a law hence construction participants are compelled people to follow it on construction sites. Furthermore, experience indicates that high health and safety standards are achieved on projects where clients are committed to health and safety and provide appropriate management oversight (Smallwood et al., 2011). The Zambian government is the major client/player in the construction industry but they have not mandated the use of the health and safety plan. Therefore, there is need to embrace the use of the health and safety plan on all government building projects as a measure to improve health and safety standards on construction sites. This will also inspire the more private sector participation apart from the USA government to adopt the health and safety plan on construction sites in Zambia.

For the plan to be effective it must include information from risk assessment and cover all relevant steps and processes, such as training, work variation, health monitoring etc. The extent of the plan will depend on the results from the assessment and the reasonably practicable methods required for effective control of the risk (Work Safe Victoria, 2005). Therefore, a risk assessment report should be done by the client before awarding the contract so as to enable the contractor prepare the health & safety plan based on the risk assessment report. It is also apparent that adequate allowance for health and safety during tendering has been a controversial issue as some contractors feel that if they make a provision for health and safety they may run the risk of losing the tender to a contractor who has not allowed for health and safety (Smallwood, 2005).

The main focus of the Health and Safety Management Plan according to the Council of Registered Builders of Nigeria (CORBON) document is on three different objectives:

- The maintenance and promotion of workers’ health and working capacity;
- The improvement of working environment and work to become conducive to safety and health; and
- The development of work organizations and working cultures in a direction which supports health and safety at work. Doing so also promotes a positive social climate and smooth operation and enhances productivity of the undertakings.
Griffith and Howarth (2011) argue that the key driver to achieving a healthy and safe working environment is to ensure that health and safety issues are assessed, planned, organized, controlled, monitored, recorded, audited and reviewed in a systematic way, the use of the health and safety plan. Failure to the use of the plan will result in the increase in accidents and poor health of workers on construction sites. The full utilisation of the plan will protect workers from accidents and illness, reduce absence and sick leave, improve productivity and profits and reduce on insurance premiums and legal costs.

3. RESEARCH METHODOLOGY

3.1 Methodology Approach

A self-completing questionnaire was favoured for this research and was administered in person. This research used both qualitative and quantitative research. The sample population comprised active participants on major construction sites in Kitwe and Lusaka provinces of Zambia. The sample population comprised 10 of 35 registered contractors in grade 1-3, 18 of 24 architectural firms and 2 regulatory bodies. The response rate was 65% of 30 questionnaires issued for the entire population. The data was analysed using content analysis to understand the variables in the data with aid of computer software.

3.2 Sampling Technique

The sample encompassed a population of three groups of participants who are active on major construction sites in Kitwe and Lusaka provinces of Zambia that would mandate a health and safety plan. The participants are namely registered contractors in grades 1-3, architects who are project managers and two regulatory bodies namely the national council for construction and building inspectors from local municipals. Non random sampling was used due to prohibitive access to elements in the population.

3.3 Survey Instrument and Data Collection

The research instrument was created with aid from literature review to assess current health and safety practices, the utilisation and implementation of health and safety plans on construction sites. A five point likert scale with 1 = “Strongly Disagree”, 2 = “Disagree”, 3 = “Neutral”, 4 = “Agree” and 5 = “Strongly Agree” was used to analyse responses. Some the questions asked include the following:

- Have you ever increased the labour force since the time you commenced the works on site?
How often do you conduct health and safety training on site during the life of the project?

3.4 Implementation
The research instrument was circulated to participants; the questionnaires included a section that introduced the study, the purpose of the study, a guarantee of anonymity and voluntary participation and instructions on how to answer the questionnaire. The participants were given the questionnaires in which they were left to answer and questionnaires collected after being fully completed.

3.5 Demographic Information
The sample population comprised 10 of 35 registered contractors in grade 1-3, 18 of 24 architectural firms and 2 regulatory bodies. Successful responses of 7 (70%) and 12 (67%) where obtained from contractors and consultants respectively. No responses were obtained from regulatory bodies.

3.6 Research Limitations
Due to time restriction, the sample size and geographical area of data collection had to be restricted. This entails that it is difficult to find significant relationships from data collected as statistical test normally require a larger sample size to ensure an adequate representation of the population.

4. RESEARCH FINDINGS AND DISCUSSION

4.1 Health and Safety Practices on Construction Sites in Zambia
Table 1 indicates that accidents causing body injury are more common than fatal accidents on construction sites with an average mean of 3.4 and 1.6 respectively. A scale of 1= does not occur, 2= not often occur, 3= fairly occur, 4= often occurs and 5= always occurs was used.

<table>
<thead>
<tr>
<th>Identified types of accidents</th>
<th>N</th>
<th>Mean rating response</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fatal accidents</td>
<td>19</td>
<td>1.6</td>
<td>1.24</td>
</tr>
<tr>
<td>Severe accidents</td>
<td>19</td>
<td>2.0</td>
<td>1.19</td>
</tr>
<tr>
<td>Body injury</td>
<td>19</td>
<td>3.4</td>
<td>1.05</td>
</tr>
<tr>
<td>Near miss/ Unsafe incidents</td>
<td>19</td>
<td>3.9</td>
<td>1.02</td>
</tr>
</tbody>
</table>
Even though fatal accidents are not common, body injuries maybe as detrimental if they result in expensive medical bills, lost income or earning ability should the injury keep the worker away from work. More effort is needed to continue containing these types of accidents and protect the lives of workers on sites.

Table 2 below represents the rating of the performance of health and safety practices in the construction industry in Zambia. A five parameter scale was used, where 1= not applicable, 2= not often, 3= fairly done, 4= often done and 5= always done and this rating were used to rate the performance of health and safety on construction sites in Zambia. From the table, inductions, the use of sign posts and health and safety talks are a common practice on construction sites while pairs of gloves, reflective jackets are less than average done. Health and safety training of selected workers, check-ups, respirators where below average while helmets, boots and gloves where rated often done and averagely done by contractors and consultants respectively. The very basic health and safety measures are being conducted on construction sites leaving much room for improvement with regard to casual worker health and safety especially.

Table 2: Rating of the frequency use of the following health and safety measures on construction sites

<table>
<thead>
<tr>
<th>Identified Areas of health and Safety practice in Zambia</th>
<th>N</th>
<th>Mean</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thorough Health and Safety Induction</td>
<td>19</td>
<td>4.7</td>
<td>1.02</td>
</tr>
<tr>
<td>Through health and safety talks</td>
<td>19</td>
<td>4.7</td>
<td>1.02</td>
</tr>
<tr>
<td>Putting up of Sign Posts</td>
<td>19</td>
<td>4.2</td>
<td>1.07</td>
</tr>
<tr>
<td>Health &amp; Safety Policy</td>
<td>19</td>
<td>4.0</td>
<td>1.08</td>
</tr>
<tr>
<td>Boots (pairs)</td>
<td>19</td>
<td>4.1</td>
<td>1.08</td>
</tr>
<tr>
<td>Helmets</td>
<td>19</td>
<td>3.9</td>
<td>1.18</td>
</tr>
<tr>
<td>First Aid Kit</td>
<td>19</td>
<td>3.6</td>
<td>1.19</td>
</tr>
<tr>
<td>Reflective Jackets (pairs)</td>
<td>19</td>
<td>3.0</td>
<td>1.24</td>
</tr>
<tr>
<td>Safety and health training of selected workers</td>
<td>19</td>
<td>2.9</td>
<td>1.19</td>
</tr>
<tr>
<td>Gloves (pairs)</td>
<td>19</td>
<td>2.8</td>
<td>1.31</td>
</tr>
<tr>
<td>Respirators</td>
<td>19</td>
<td>2.8</td>
<td>1.31</td>
</tr>
<tr>
<td>Health and Safety checks up</td>
<td>19</td>
<td>2.7</td>
<td>1.34</td>
</tr>
<tr>
<td>Safety goggles</td>
<td>19</td>
<td>2.6</td>
<td>1.83</td>
</tr>
</tbody>
</table>

All (100%) of the respondents agreed that the health and safety Officer was responsible for conducting HIV/AIDS awareness on construction sites in Zambia. Table 3 shows the summary of respondent ratings on HIV/AIDS sensitisation on construction sites. A five point scale
was used in rating the awareness of respondents: 1= not done, 2= not often, 3= fairly done, 4= often done and 5= always done.

HIV/AIDS sensitisation is not often done on construction sites especially those in urban areas; such programmes are much more proactive in rural areas. Sensitisation should not only be effective on sites in rural areas, but on sites in urban areas, as HIV/AIDS is a widespread problem irrespective of location.

Table 3: summary of ratings on HIV/AIDS sensitisation on construction sites

<table>
<thead>
<tr>
<th>Identified parameters associated with HIV/AIDS programme</th>
<th>N</th>
<th>Mean rating response</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>HIV/AIDS Sensitisations</td>
<td>19</td>
<td>2.15</td>
<td>1.34</td>
</tr>
<tr>
<td>Distribution of Condoms on site</td>
<td>19</td>
<td>1.6</td>
<td>1.54</td>
</tr>
<tr>
<td>Accessibility of ARV’S on site</td>
<td>19</td>
<td>1.4</td>
<td>1.76</td>
</tr>
<tr>
<td>Permission to go to the clinic when one is unwell</td>
<td>19</td>
<td>3.6</td>
<td>1.02</td>
</tr>
</tbody>
</table>

All (100%) construction sites had a written health and safety policy on site. This tells us that it is up to the employer to impart health and safety awareness in the workers as they carry out daily construction tasks. The majority of respondents (about 80%) that had worked durations of between 1.5- 2 years on a particular project confirmed that the labour force had increased since commencement of the works. This was especially observed when new sections of works were introduced.

The data shows that, most of contractors do not provide health and safety training to their casual workers. Casual workers are engaged in large numbers to work for short periods of time hence investing in them only to lose them to another employer or when sections of works are done is a waste of resources. Hence offering health and safety training to them would be very expensive. They are not imparted with new knowledge through training, only awareness is imparted through health and safety induction.

However, 71.4% of respondents stated that between 0 - 2 times of health and safety training was done during the life of the project Therefore it can be concluded that contractors are putting very little efforts in training/ equipping the workers on construction sites in terms of health and safety.

4.2. The frequency use of parameters of the Health and Safety Plan on construction sites

Table 4: summary of the frequency use of the health and safety plan on Construction sites in Zambia
Identified health and safety measures on construction projects

<table>
<thead>
<tr>
<th>Identified area of cover</th>
<th>N</th>
<th>Mean Rating</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>First aid arrangements</td>
<td>19</td>
<td>3.4</td>
<td>1.01</td>
</tr>
<tr>
<td>Site Induction</td>
<td>19</td>
<td>3.3</td>
<td>1.02</td>
</tr>
<tr>
<td>Site rules and fire evacuation procedures</td>
<td>19</td>
<td>2.9</td>
<td>1.04</td>
</tr>
<tr>
<td>Welfare facilities</td>
<td>19</td>
<td>2.6</td>
<td>1.06</td>
</tr>
<tr>
<td>Management structure and responsibilities for the health and safety</td>
<td>19</td>
<td>2.6</td>
<td>1.06</td>
</tr>
<tr>
<td>Consultation with the workforce</td>
<td>19</td>
<td>2.5</td>
<td>1.08</td>
</tr>
<tr>
<td>Information exchange on health and safety between contractors on site</td>
<td>19</td>
<td>2.5</td>
<td>1.08</td>
</tr>
<tr>
<td>Programme of works highlighting residual risk</td>
<td>19</td>
<td>2.5</td>
<td>1.08</td>
</tr>
<tr>
<td>Production and approval of method of statement</td>
<td>19</td>
<td>2.4</td>
<td>1.09</td>
</tr>
</tbody>
</table>

Most of the components that contains in the plan are practised on construction sites but the written document itself is rarely used by contractors on sites with the exception of USAID funded project where they are mostly used in Zambia.

Table 5: summary on how health and safety costs in a contract are covered by consulting team

<table>
<thead>
<tr>
<th>Identified area of cover</th>
<th>N</th>
<th>Mean rating (average)</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Include health and safety costs in P&amp;G’S</td>
<td>12</td>
<td>3.8</td>
<td>1.02</td>
</tr>
<tr>
<td>Separate bill for health and Safety plan costs</td>
<td>12</td>
<td>2.0</td>
<td>1.34</td>
</tr>
<tr>
<td>Engage independent health and safety contractor</td>
<td>12</td>
<td>1.9</td>
<td>1.36</td>
</tr>
<tr>
<td>Others specify (health and safety environmental report)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

From the above information it can be clearly seen that consulting firms mostly use P&G’S costs in order to cover for the health and safety on a construction projects in Zambia. This method has a negative impact in that contractors have the tendency of reducing the P&G’S cost due to stiff competition on the market, hence, the health and safety allocation is greatly affected.

In assessing time, cost, quality and health and safety as project parameter, a majority of 27% of the respondents alluded to cost as being the most important parameter with health and safety coming in last at
23.5%. This simply entails that cost is considered as a critical project parameter, meaning that contractors and consultants do not want costs to be compromised on a project.

5. CONCLUSION

Accidents are a common occurrence on construction sites in Zambia. The most occurring types of accidents are those resulting in physical harm to the body with very minimal fatalities. Causal workers are more prone to body harm because of the conditions they work in and the nature and terms of employment. Having low incomes and being on temporal employment with the consequence of always fearing for their jobs, casual workers tend to accept whatever work environments are dictated on them. Contractors tend to provide the very bare minimum when it comes to health and safety especially if the client is not explicit about this i.e. the use of a health and safety plan.

Health and safety measures on construction sites are on average being executed, but can be improved further by mandating their use. Contractors tend to be cost effective by not providing for what is in the best interest of the people directly involved with the work. According to the findings from the survey the health and safety plan was underutilised as it was evident that the plan was unavailable even on the biggest sites in Lusaka and Kitwe.

6. REFERENCES


Zulu, C. 2014, Interview conducted with an inspector at the Kitwe City Council, Public Health Department on 11/07/14.
Study to compare deterministic and probabilistic Methods of Contingency Sum Determination in the Zambian Construction Industry

Nonde Lushinga, Danstan Chiponde, Lawrence P. Mutale, Josephine Mtwale and Kelvin Daka
The Copperbelt University, School of Built Environment, Department of Construction Economics and Management
P.O. Box 21692 Kitwe Zambia 10101
Emails: nonde.lushinga@gmail.com; chiponded@yahoo.com; lawrence.mutale@cbu.ac.zm; josephinemutwale@gmail.com
Mobile number: +260961409598

ABSTRACT AND KEYWORDS

Purpose of this paper
The purpose of this research was to compare traditional deterministic percentage method of contingency estimation with the probabilistic method with a view of establishing the most accurate method of estimating contingency. In Zambia, contingency values are often miscalculated resulting in project overruns.

Design/methodology/approach
In this study, a population of 132 comprising consulting architects, quantity surveyors and engineers was targeted. A sample size of 91 was calculated based on Kish’s formula but ultimately a representative sample size of 60 was selected. Structured questionnaires were administered. About 7 completed building projects in Zambia were identified and their cost overruns established. Importance index was used to rank the risk factors affecting project contingency. Then Kendall’s coefficient of concordance was used to correlate the degree of agreement between respondents.

Findings
The study found a strong correlation between the cost overruns on completed building projects and the contingency values estimated using probabilistic method. Conversely the contingency values estimated using traditional percentage or deterministic approach was found to be far below the recorded cost overruns on 7 projects. This meant that probabilistic method was more accurate than deterministic method as it could cover the unforeseen costs adequately.
Research limitations/implications (if applicable)
Due to limitations of cost and time only consulting firms in the capital Lusaka and Kitwe were considered.

Practical implications (if applicable)
Almost all construction projects use traditional percentage or deterministic method of contingency estimation but is often inadequate resulting in cost overruns. Probabilistic method of contingency estimation may be used as an alternative.

Key Words
Contingency; Deterministic method; Probabilistic method, Importance index, Kendall’s coefficient of concordance

1.0 INTRODUCTION
Contingency has been defined as the percentage of a construction budget that is put aside to accommodate unknown factors and uncertainties connected to the project (Siwingw, 2016).

In the Zambian Construction Industry (ZCI), it is common practice to simply add a standard percentage is to the cost estimate which is usually between 5 and 15 %. This traditional or deterministic method relies on preceding experience of the quantity surveyor with projects of the similar nature (Siwingw, 2016). Hartman (as cited in Barde, 2015) argues that this method is an unscientific and thus a reason why so many projects finish over budget. Traditional percentage (deterministic) method has thus a challenge of producing inaccurate contingency estimates as it does not assess the risk factors likely to affect the project. Circumstances often exist where the order of difficulty and complexity require higher order of percentages to take account of the greater degree of risk involved (Jaggar, 2007). A study conducted by Siwingw, (2016) in Zambia to determine whether the traditional or deterministic method was adequate concluded that contingency sum was inadequate and hence the need to adopt a method that can accurately and objectively predict the contingency sum for construction projects as contingency sum under traditional percentage was not always adequate on the project (ibid).

This research compares traditional deterministic method of contingency estimation with a probabilistic method with a view of establishing the most accurate approach in the construction industry. The aim of the research will be achieved by the following objectives:
1. Assess the current methods used in contingency estimation in the Zambian Construction Industry
2. Review the methods and risk factors affecting contingency sum estimation in Zambia
3. Establish the most accurate method of contingency estimation between probabilistic and deterministic methods based on completed projects in Zambia.

2.0 BACKGROUND AND LITERATURE REVIEW

2.1 Concept of Contingency

Contingency has been defined as the percentage of a construction budget that is put aside to accommodate unknown factors and uncertainties connected to the project (Siwingw, 2016). Contingency sum is included to cover unforeseen items and eventualities which occur during the construction of the project and can vary in amount depending upon the project size and type (Roger Flanagan, 1997). A contingency is thus a cost element included in project cost estimation to cover costs that have some likelihood of occurrence but whose amounts cannot be predicted with certainty (Rosalie T Ruegg, 1990).

By adding the contingency sum to the estimates of the project costs, the quantity surveyor hopes to project the most likely final cost. According to Demkin and AIA (as cited in Siwingw, 2016), contingency fund is used as leverage against errors and omissions in construction documents, change in the scope of the project, and to pay for unknown conditions. Other uses of contingencies are to cover possible increases in materials or labour costs beyond normal escalations, unanticipated work disruptions when operating in a politically volatile country. Analysts often estimate contingency as a percentage of the base estimate of the project. Historical data on the differences between actual and estimated costs for similar projects are sometimes useful in determining an average percentage of underestimation or overestimation subject to assessment of the possibility of unforeseen problems. Buccari (as cited in Siwingw, 2016) noted that most organizations do not have guidelines to help in contingency estimation and management of contingency funds. This fund is often miscalculated and the result is either an underestimated or overestimated amount.

2.2 Types of Contingency

Roger Flanagan, (1997) observed that potentially during cost planning stages from outline proposals onwards, there are four contingency factors to be considered by the cost planner and design team:

1. Planning contingency
2. Design (risk) contingency
3. Contract contingency
4. Project contingency

The Association of Australian Quantity Surveyors (as cited in Roger Flanagan, 1997) has defined these contingencies as follows:

*Planning Contingency:* an allowance to cover the risk of not being able to design the spatial relationships and achieve the desired functional area and travel/engineer’s allowances. The planning contingency is reduced to zero at sketch design (detail proposal) stage.

*Design contingency:* an allowance to cover the risk of the estimator/cost planner not adequately foreseeing the correct design or the complexity of the design. The amount of detail available and will be reduced to zero at tender document stage (production information).

*Contract contingency:* is an allowance to cover the risk of variations and unforeseen items encountered during construction.

*Project Contingency:* this may also be added to cover delays and / or inflation, major changes required by the client or authorities, free negotiations and similar.

Contract contingency is the amount or allowance that comes forward into the tender. Like the other contingencies it generally reduces in magnitude as the design progresses until at the tender stage it would reflect the percentage to be included in the contract documents. Thus in normal circumstances the percentage may range from around say 5% in the early stages to fall to possibly as low as 1% or 2% in the tender document stages subject to assessment of the possibility of unforeseen problems. Circumstances exist where the order of difficulty and complexity require a higher order of percentages to take account of the greater degree of risk involved. Similarly on a repetitive design team used to a particular design and constant system on a normal site the percentage is likely to be lower (Jaggar, 2007). This study focuses on contract and project contingencies. The research problem was that the contract and project contingencies are often not sufficient to cover for the unforeseen risks on construction projects. This problem is attributed to the use of deterministic methods of contingency estimation which adds a fixed percentage to the total budget of the project.

Contingency can have a major impact on project outcome for a project owner. If contingency is too high it might encourage poor cost
management, cause the project to be uneconomical and so aborted. It may also lock up funds not available for other projects or activities.

2.3 Methods of Contingency Estimation
There are many methods which exist and used in contingency сум estimation in many countries (Oduro, 2008). There are numerous estimating methods available for project cost contingency as shown below: (1) traditional percentage (2) method of moments; (3) Monte carlo simulation; (4) factor rating; (5) individual risks – expected values; (6) Range estimating; (7) Regression Analytical; (8) Artificial neural networks (9) Fuzzy Sets; (10) Controlled interval memory and (11) Influence diagrams and (12) analytical hierarchy process (Baccarini, 2004).

When estimating, the most common method of allowing for uncertainty is the addition of a percentage contingency value to the most likely estimate of the final cost of the known works. Although this contingency can be calculated in various ways as detailed previously, the most common way is to consider around 10% of the estimated project cost (Burger cited in (Adama, 2014). Hartman (as cited in Barde, 2015) argues that this is an unscientific approach and thus a reason why so many projects finish over budget.

When estimating, the most common method of allowing for uncertainty is the addition of a percentage contingency value to the most likely estimate of the final cost of the known works. Although this contingency can be calculated in various ways as detailed previously, the most common way is to consider around 10% of the estimated project cost (Burger cited in (Adama, 2014). Hartman (as cited in Barde, 2015) argues that this is an unscientific approach and thus a reason why so many projects finish over budget.

2.3.1 Traditional Percentage (Deterministic) Method
This method assigns a percentage on the base estimate of project cost and is also known as the Crystal Ball method for contingencies and has been used widely (Moselhi as cited in Adama, 2014). It involves the setting of a blanket percentage as mentioned earlier, usually between 5% and 10% of total project cost to cover contingencies. This method is the most common in Zambia despite researchers criticizing the model as failing to acknowledge the underlying project risks that drive the need for contingency and therefore exposes the organization to the problem of either overcompensating for the risk or more likely underestimating. Yeo (as cited in Jeremy, 2010) noted that the conventional method of contingency allocation is in danger of being overly simplistic and too heavily dependent on an estimator’s own experience.
And Baccarini (2004) conducted an analysis of 48 roads projects completed by the Australian government and found that these projects allocated an average contingency of 5.24% of the award contract value, but that the average actual variations in the final construction cost was 9.92%. In other words, the contingency allocated was, on average 47% too little to cover the actual variance in construction costs. In the same study Baccarini (2004) also found that there was no relationship between the magnitude of contingency allocated at the start of construction and the ultimate variance in construction cost. Simply stated, there was no evidence that the contingency reserves for these projects managed successfully to acknowledge the actual risks inherent in the projects. Because of this problem, this study will use probabilistic method with a view of comparing results with deterministic method of contingency estimation. In this study, deterministic estimation will be based on this simple model and will be adapted to a specific project that has been completed so that the initial contingency value could be compared with the actual contingency expended on the project.

2.3.2 Probabilistic Method

The probabilistic methods engage the aspect of probability to them. They are also subdivided into independent and correlated methods which are further divided into direct and simulation methods. Both independent and correlated approaches are themselves broken down into direct and simulated approaches, with direct approaches relying on techniques such as the central limit theorem and variations (PERT), while Monte Carlo is the most widely used of the simulation methods.

Oduro (2008) used probabilistic model based on contingency calculator adapted from the American Association of Cost Engineers (AACE) in a study conducted in Ghana. This method is a visual basic programme designed to cover identified factors influencing the determination of contingency sum. The factors considered in this method are Economic, Technical and Environmental/Cultural factors. Figure 2 shows factors affecting contingency estimation under probabilistic estimating as postulated by AACE.

In the study conducted by Odoro (2008), respondents were asked to rate the percentages of risk associated with the following factors based on their industrial experience of similar works: Technical; Environmental/Cultural and Economic factors. Each of these minor factors had risk rated values, which vary depending on conditions and the impact of risk. The formula is as follows:

\[ \text{Contingency sum} = \Sigma a + b + c \]  
Eq. 1
Where: 

- $a=$ Percentage of Environmental/Institutional factors (20%) 
- $b=$ Percentage of Economic Factors (60%) 
- $c=$ Percentage of Technical Factors (20%)

The percentage of the environmental factors can be calculated as follows:

$$a = \frac{(a_1 + a_2 + a_3)}{100} \times 20,$$

where: 

- $a_1=$ Percentage of Demand for Material (0-55%) 
- $a_2=$ Percentage of Force Majeure (0-35%) 
- $a_3=$ Percentage of Cultural Factors (0-10%)

$$b = \frac{(b_1 + b_2)}{100} \times 60,$$

where: 

- $b_1=$ Percentage of Inflation (0-65%) 
- $b_2=$ Percentage of Global Economic Pressure (0-35%)

$$c = \frac{(c_1 + c_2 + c_3 + c_4 + c_5)}{100} \times 20,$$

where: 

- $c_1=$ Percentage of Design Consideration (0-20%) 
- $c_2=$ Percentage of Project Management (0-10%) 
- $c_3=$ Percentage of Project Duration (0-15%) 
- $c_4=$ Percentage of Form of Contract (0-40%) 
- $c_5=$ Percentage of Project Specification (0-15%)

The percentage added in the respective risk factors were obtained through the analysis of a risk by the consultant team based on its likely hood of occurrence and subsequently contingency values estimated.

3.0 RESEARCH CRITERIA AND METHODOLOGICAL APPROACH

3.1 Research design

The population was identified and the sample selected which involved consulting firms in the Zambian Construction Industry (Quantity Surveyors, Architects and civil/Structural Engineers) but excluded contractors to avoid biasness. The research instruments were designed, which mainly involved questionnaires because of the nature of the research which aimed at figures and values and a bit of interviews where necessary.

The research began by conducting a survey in Kitwe and Lusaka targeting consulting firms. It then incorporated the data collection process which involved the collection of primary data and secondary data. The primary data collected was mainly the rankings of the factors affecting the determination of the contingency funds by professionals and also the allocation of percentages to the factors so that calculations of contingency can be based on Zambian information.
Then seven (7) projects were picked to test the suggested method against the existing one in comparison to the cost overrun on each project and lastly all the data collected was analysed and the analysis was done in two ways:

- Firstly, the collected data on the ranked factors, uses and methods was analysed using important index and the agreement between the sampled building professionals was made by Kendall’s Concordance Analysis which measures the degree of agreement among sets of ranking and the significance of Kendall’s Concordance Co-efficient was tested using the chi-square test of distribution.
- Then the second part involved the testing of the research’s hypothesis using the simple mathematical analysis.

3.2 Sampling techniques and size

For the purposes of the success of this research, the random sampling technique (stratified) was used. This method was taken out of convenience and also because of that it is suitable when you have a population which is in distinguishable layers or strata that are different from each other (Crawshaw, 2001). Moreover, Oduro (2008) used it in a similar research and it proved to be successful. Kish’s formula was used to obtain sample size:

\[
n = \frac{n'}{1 + \left(\frac{n'}{N}\right)}
\]

Equation (5)

Where:
- \( n \) = Sample Size
- \( n' = \frac{S^2}{V^2} \)
- \( N \) = Population Size
- \( S \) = Maximum standard deviation in the population element (total error = 0.1 at a confidence level of 95%)
- \( V \) = Standard error of sampling distribution = 0.05
- \( P \) = the population elements.
- \( S^2 = P (1-P) = 0.5(1-0.5) = 0.25 \)

Based on kish’s formula, the sample was obtained as shown in table 3 below:

<table>
<thead>
<tr>
<th>Consulting firm</th>
<th>Population size</th>
<th>Sample size</th>
<th>Minimum Representative sample size</th>
<th>Number of questionnaire s allotted</th>
</tr>
</thead>
<tbody>
<tr>
<td>Architectural consulting</td>
<td>31</td>
<td>38</td>
<td>23</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>Quantity surveying consulting</td>
<td>60</td>
<td>24</td>
<td>12</td>
</tr>
<tr>
<td>--------------------------</td>
<td>--------------------------------</td>
<td>------</td>
<td>------</td>
<td>------</td>
</tr>
<tr>
<td></td>
<td>Civil / structural engineering consulting</td>
<td>41</td>
<td>29</td>
<td>15</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>132</td>
<td>91</td>
<td>50</td>
</tr>
</tbody>
</table>

Source: Engineering Institution of Zambia (2014); Zambia Institute of Architects (2014) and Surveyors Institute of Zambia (2014)

### 4.0 ANALYSIS OF DATA

The data collected on the uses, methods and factors was analysed using an important index. This method is used for ranking factors and it was used for the same purpose in this research. It was computed by the formula shown below:

\[
I = \frac{100 \sum (a_i f_i)}{AF}
\]

Equation (6)

Where:

- \(I\) = important index
- \(a_i\) = variable expressing the weight of the \(i^{th}\) term ranging from 1-4
- \(A\) = highest weight, that is 4
- \(f_i\) = frequency of the \(i^{th}\) response
- \(i\) = response category index, where \(i = 1, 2, 3, 4\)
- \(F\) = total number of respondents.

Based on the important indices, the factors for determining contingency were ranked and the agreement between the sampled building professionals was determined by the use of the Kendall’s concordance analysis. The Kendall’s concordance co-efficient \((W)\), which measures the degree of agreement among sets of ranking, is a well renowned formula and stands out to be very useful when it comes to measuring agreement among individuals rating a single item (Zaiontz, 2014). Therefore, in this research it was also used for the same purpose to measure the degree of agreement among the set of rankings.

\[
W = \left[ \frac{\sum_{i=1}^{k} (R_i - R)^2}{n(n^2-1)} \right] \frac{12}{n(n^2-1)}
\]

Equation (7)

Where \(W\) = Coefficient of Concordance

- \(k\) = the number of set of ranking (e.g. the number of judgments/groups ranking)
n = the number of aspects of a problem or factors being ranked.

\[ \bar{R} = \frac{1}{2} \sum_{i=1}^{n} (R_i - \bar{R})^2 \]

= the maximum possible squared deviation i.e., the numerator which will occur if there were perfect agreement among k sets of ranks, and the average ranking were 1,2,3….n.

\[ R = \text{the rank assigned by an individual judge to one aspect of the problem posed.} \]

The value of W ranges from 0 – 1 regardless of the number of rankings.

5. RESULTS AND DISCUSSION

5.1 Agreement of ranked risk factors among building professionals

All the risk factors likely to occur and affect the 7 projects during construction were identified and ranked by consulting architects, quantity surveyors and civil engineers. Then the rankings were correlated as regards the degree of agreement using Kendall’s coefficient of concordance as shown in table 3 below.

Table 2: Agreement between building professionals on factors influencing the determination of contingency sum.

<table>
<thead>
<tr>
<th>Factors</th>
<th>Quantity Surveying firms</th>
<th>Architectural firms</th>
<th>Civil Engineering firms</th>
<th>Sum of Ranking ( R_i )</th>
<th>Means of Ranking ( \bar{R} )</th>
<th>( R - \bar{R} )</th>
<th>( (R - \bar{R})^2 )</th>
<th>Overall Ranking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Form of Procurement / Contract</td>
<td>8</td>
<td>8</td>
<td>3</td>
<td>19</td>
<td>6.3</td>
<td>1.1</td>
<td>1.21</td>
<td>7th</td>
</tr>
<tr>
<td>Project Specification</td>
<td>2</td>
<td>2</td>
<td>5</td>
<td>9</td>
<td>3</td>
<td>-2.2</td>
<td>4.84</td>
<td>2nd</td>
</tr>
<tr>
<td>Project Duration</td>
<td>7</td>
<td>2</td>
<td>5</td>
<td>14</td>
<td>4.7</td>
<td>0.5</td>
<td>0.25</td>
<td>4th</td>
</tr>
<tr>
<td>Project Management</td>
<td>5</td>
<td>7</td>
<td>4</td>
<td>16</td>
<td>5.3</td>
<td>0.1</td>
<td>0.01</td>
<td>5th</td>
</tr>
<tr>
<td>Design Consideration</td>
<td>1</td>
<td>4</td>
<td>5</td>
<td>10</td>
<td>3.3</td>
<td>-2</td>
<td>4</td>
<td>3rd</td>
</tr>
<tr>
<td>Inflation</td>
<td>3</td>
<td>4</td>
<td>1</td>
<td>8</td>
<td>2.7</td>
<td>-2.8</td>
<td>6.76</td>
<td>1st</td>
</tr>
<tr>
<td>Global economic pressure (increase in demand for fuel)</td>
<td>4</td>
<td>10</td>
<td>2</td>
<td>16</td>
<td>5.3</td>
<td>0.1</td>
<td>0.01</td>
<td>5th</td>
</tr>
<tr>
<td>Force Majeure</td>
<td>9</td>
<td>4</td>
<td>9</td>
<td>22</td>
<td>7.3</td>
<td>2.1</td>
<td>4.41</td>
<td>9th</td>
</tr>
<tr>
<td>Cultural Factors</td>
<td>10</td>
<td>1</td>
<td>10</td>
<td>21</td>
<td>7</td>
<td>1.8</td>
<td>3.24</td>
<td>8th</td>
</tr>
<tr>
<td>Increase in demand for extractive Materials</td>
<td>6</td>
<td>8</td>
<td>8</td>
<td>22</td>
<td>7.3</td>
<td>2.1</td>
<td>4.41</td>
<td>9th</td>
</tr>
</tbody>
</table>

(Timber, Steel etc)
The coefficient of concordance for the selected building professionals using equation (7) was found to be 0.455. Kendall’s coefficient of concordances represents agreement, where the value of 0 indicates that there is no agreement and the value of 1 means that there is an agreement. Therefore, the value of 0.455 in this case indicates that there is a fair agreement.

5.2 Accuracy of the contingency estimates

From figure 1 below, it can be seen that the actual contingencies expended on 7 projects correlated well with probabilistic method of contingency estimating. Furthermore, contingency estimates derived from traditional deterministic approaches were far below the expended contingency after completion of the projects.

![Graph Showing Relationship Between Contingency Sum using proposed method and the traditional method](image)

Figure 1: Relationship between expended contingencies and estimated contingencies based on traditional percentage and probabilistic approaches

Table 3: shows difference in the estimated contingencies using the two methods against the cost overrun.

<table>
<thead>
<tr>
<th>Project</th>
<th>Contingency based on deterministic method (%)</th>
<th>Contingency based on Probabilistic Method (%)</th>
<th>Overrun after Completion (%)</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>D=C-A</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E=C-B</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 1 above shows the performance of contingency on 7 building projects in Zambia. The project contingency on 7 projects was estimated using traditional percentage method which ranged from 5 to 10 percent as shown in column A. Probabilistic method was also used where all possible risk factors on 7 projects were fully assessed by industry experts and contingency sums estimated accordingly as shown in column B. The recorded cost overruns on these projects after completion are shown in column C. In columns D and E, the two contingency values were compared with the project cost overruns and results showed a strong correlation between probabilistic estimating and the actual contingencies expended. However traditionally percentage estimated contingency was far below the expended showing that it was not realistic.

6. CONCLUSIONS AND RECOMMENDATIONS

From the results of the study, it was concluded that contingency estimates based on probabilistic approaches had strong correlation with the cost overruns implying that the method was more accurate. On the other hand, the traditional percentage contingency was far below the overruns implying that it was unrealistically low to cover the unforeseen conditions on the construction project.

The study strongly recommends the use of probabilistic methods of contingency estimation in order to reduce unnecessary cost overruns.
7. REFERENCE


Infrastructure Accessibility in New Public Urban Mass Housing Settlements in Addis Ababa, Ethiopia

Denamo A. Nuramo
E-mail: denamo.addissie@eiabc.edu.et
University of KwaZulu-Natal, Durban, South Africa
Tel: +27 712 960-884 (mobile); +27 31 260-3241 (office)
Orcid.org/0000-0002-5661-3653

Prof. Theodore C. Haupt
E-mail: pinnacle.haupt@gmail.com
University of KwaZulu-Natal, Durban, South Africa
Tel: +27 82 686-3457 (mobile); +27 31 260-2712 (office)
Orcid.org/0000-0002-2531-3789

ABSTRACT

Purpose of this paper
This paper attempts to investigate residents’ satisfaction about accessibility of infrastructure services to new public housing settlements in Addis Ababa, Ethiopia.

Research Methodology
Primary data was gathered through a structured interview survey from 94 residents living in new public housing settlements in five different locations in Addis Ababa. Purposive and stratified sampling techniques were used and the interview was conducted in the local language, Amharic. Interview questions were developed from literature review and were targeted to investigate residents’ level of satisfaction about accessibility of selected infrastructure services to their residential units. On-site observations were made to attest the information acquired from residents. SPSS version 23 software was used to analyze the data.

Findings
Interview results showed that majority of residents are not satisfied with accessibility of most of the infrastructure services. The on-site observation has attested results of the interview.

Research limitations
This research is limited to public low-cost housing projects that are constructed within 10 years in five purposely selected settlement sites in...
Addis Ababa. Only transport, education, health, electric power, tap water, recreation, drainage and waste disposal infrastructure services are included in the research.

Practical implications
The findings of this paper provide vital information to the Addis Ababa city government to make informed decisions in the existing and newly planned housing schemes with regards to infrastructure accessibility.

Value
The research is believed to fill the research gap in accessibility of infrastructure to new public housing settlements in Addis Ababa.

Keywords: Infrastructure services, accessibility, Public residential houses

1. INTRODUCTION

Currently, more people live in the urban areas than in the rural. Rapid urbanisation poses a major challenge to providing adequate housing and infrastructure in urban areas in developing countries. It creates considerable demand on infrastructure services including transport, energy, clean water, waste disposal, drainage, healthcare, education and recreational facilities.

Urban areas of Africa are experiencing high population growth rate of 3.09% which is the highest in the world (The World Bank, 2015). Currently, more than 400 million people are residing in urban areas of Africa where this is expected to rise to 1.2 billion by 2050 (The World Bank, 2015).

Due to rural-urban migration and natural population growth there is critical shortage of residential houses in most African cities including Addis Ababa, the capital city of Ethiopia. Population growth rate of Addis Ababa is estimated to be about 2.1% (A.A. BoFED, 2013). With only 16.7% of its population residing in urban areas, Ethiopia is one of the least urbanized countries in the world. However, the country is currently experiencing a rapid annual urban population increase rate of 3.49% (UN-HABITAT, 2011).

To alleviate the housing shortage in Addis Ababa, the city administration together with other governmental and non-governmental organizations launched a massive housing development program in the year 2004. The program is named Integrated Housing Development Program (IHDP) and it is aimed at low and middle income residents of the city. It had the initial goal of constructing around 400,000 condominium units in five years in Ethiopia where 175,000 of the units were planned to be constructed in Addis Ababa.

Since 2004 more than 100,000 condominium units have been constructed and transferred to beneficiaries (BoFED, 2015). In Addis Ababa basic urban and infrastructure services are provided by the Government. It is the responsibility of the city administration to provide the settlements with
infrastructure and services including roads, car parks, footpaths, water, electric power and sewerage systems (UN-HABITAT, 2011).

Evidently new urban settlements and extensions have played a notable role in alleviating housing shortages in developing countries. This solution would be long lasting only if these new settlements and urban extensions are provided with adequate infrastructure. The delivery of services like healthcare, education, water, sanitation, transportation and energy not only directly benefits the urban poor but also dramatically improves their welfare.

To ensure sustainability of these housing programs, it is imperative to assess post-occupancy issues including satisfaction of residents about accessibility of infrastructure services. While access in the context of urban areas is relatively higher, it remains low for the urban poor (The World Bank (a), 2011).

A study in Tanzania (Olvera, et al., 2003) outlined the following implications of lack of accessibility:

- poor households limit their outside the neighbourhood movement to the most essential activities;
- reduces the number of accessible jobs;
- reduces productivity of workers, especially the poor;
- prevents the development of social capital;
- contributes to social exclusion.

Therefore, to ensure sustainability of public housing programs, it is imperative to assess post-occupancy issues including satisfaction of residents about accessibility of infrastructure services. While access in the context of urban areas is relatively higher, it remains low for the urban poor (The World Bank (a), 2011). To this effect this research attempts to investigate satisfaction of residents about accessibility of infrastructure services to new public housing settlements in Addis Ababa.

The subsequent part of this paper has four sections. Section 2 outlines the literature review followed by section 3 which deals with research design and methodology. Results and discussion are presented in section 4. Section 5 puts forward conclusion and recommendations.

2. LITERATURE REVIEW

2.1 Accessibility Defined

Accessibility doesn't have a unification concept and unequivocally agreed definition. According to Penchansky & Thomas (1981) access is defined in terms of five elements namely Adequate, Accessible, Affordable, Appropriate and Available. Cambridge Dictionaries Online (Cambridge University Press, 2016) defines accessibility as "the quality or characteristic of something that makes it possible to approach, enter, or use it." McGrail
& Humphreys (2009) outlined that geographical or spatial accessibility is considered as an essential element of the concept of accessibility.

In the general sense, accessibility can be expressed in terms of both spatial and time aspects. Weiping & Chi (2011) depicted that accessibility displays the convenience degree of a place as spatial gentility and they further explain that time is the main impedance factor of accessibility.

2.2 Infrastructure Services

The subsequent sub-sections describe the infrastructure systems considered in this study.

2.2.1 Transport Infrastructure

Researches have indicated that well-managed urban development and provision of accessible and affordable public transport benefits especially the urban poor and disadvantaged by providing a better access to goods, services, and economic opportunities (Rode, et al., 2014). Literature on urban transport has outlined unplanned development at the suburban periphery with inadequate infrastructure, transport and other public services as among the main underlying causes of transportation problems in developing countries (Puchera, et al., 2005). Affordable transport services improve accessibility to improved educational and employment opportunities.

2.2.2 Healthcare Infrastructure

The Australian Institute of Health and Welfare (Ware, 2013) defines accessible health services as "those that are physically available, affordable, appropriate and acceptable". The physical availability of health care infrastructure doesn't necessarily ensure the user's ability to access it. The distance patients travel, the reliability and quality of service rendered by the health organizations and affordability of the service influence accessibility of the healthcare facilities.

Accessibility of healthcare infrastructure especially those run by the public should be given prime importance. Densely populated urban areas are prone to high rate of diffusion of pathogens. Particularly the urban poor in new housing settlements can't afford to get treatment in private hospitals and clinics. It is important to bear in mind that even some portion of the population is reliant on the governments subsidy to get treatment in Government run healthcare facilities.

2.2.3 Educational Facilities
Provision of adequate educational facilities is vital in the strive to alleviate poverty in developing countries. In line with provision of facilities it is vital to ensure that they are accessible to all particularly to the urban poor. Literature revealed that distance is one of the factors contributing to low enrolment in public schools in Nigeria (Oluwadare & Julius, 2011). Research on school dropout among girls has pointed out that if school distance is too far from home, young girls tend to drop out more (Shahidul & Karim, 2015). Research indicated that close proximity to schools had a positive motivating impact on girls (Ainsworth, 2005).

2.2.4 Energy Infrastructure

According to the World Bank report (2011), while access to energy is crucial for the poor to break out of the poverty trap, the urban poor populations continues to face lack legal access to cleaner and sustainable energy. In sub-Saharan African countries, access to energy is one of the fundamental challenges in relation to sustainable development.

2.2.5 Market and Recreational Facilities

Recreational facilities and open spaces are one of the important elements of urban environment and that improve physical and psychological health, improve social cohesion and make urban areas more attractive to live and work.

Urban areas shouldn't only have access to recreational facilities but they should also have adequate access to market facilities. Formal and informal shopping outlets are the main components of market facilities in new urban settlements. As urban dwellers are characterized as high consumer of goods including groceries, clothes, and house cleaning items, the importance of accessibility of market places highly important.

2.2.6 Drainage and Waste Disposal

Inadequate waste disposal systems in densely populated areas contribute to ground water pollution and spreading of diseases including diarrhoea and cholera. Research has indicated that sanitation is the single most cost-effective intervention to reduce child mortality (The World Bank, 2006).

Like other developing countries, in Ethiopia, solid waste from households is brought to communal bins shared among neighbourhoods. Collecting solid waste in communal bins affects impacts of waste on the surrounding environment (Regassa, et al., 2011).

Research conducted in two sub-Cities in Addis Ababa has found that inaccessibility of the city due to geographical and urban structure, lack of properly designed collection route system and time schedule are some of the reasons for low performance of Solid Waste Management in the city (Regassa, et al., 2011).

2.2.7 Drinking Water Supply
Access to clean water is essential for health, livelihood and quality of life. While clean water accessibility problem exists both in rural and urban areas of developing countries, it is found to be significantly pressing in the cities (J-PAL, 2012). It is reported that only 35% of the sub-Saharan African population has access to piped water. While governments are putting effort to improve the situation, more than 165 million people in cities of developing countries still lack access to even the minimal quality of fresh water (Davis, et al., 2008). It is worth noting that inaccessibility of safe drinking water has direct impact on health, sanitation and livelihood of residents.

3. METHODOLOGY

3.1 The Study Area

The study was conducted in from March to May 2016 in Addis Ababa. Addis Ababa is the capital city of Ethiopia and it is geographically located at the centre of the country. According to the Ethiopian Government estimate the population of Addis Ababa is projected to reach 3.4 million in 2016 (FDRE CSA, 2013). The city is the largest urban centre where more than 20% of the country’s urban population resides. The total area of the city is 540 km² and it is divided into ten sub-cities (A.A. BoFED, 2013). Table 1 depicts population, area and density of Addis Ababa and its ten sub-Cities.

Table 1 Population of Addis Ababa and its Sub-cities in 2012 (BoFED, 2015) (Modified by the Authors)

<table>
<thead>
<tr>
<th>Sub-Cities</th>
<th>Population</th>
<th>Ratio to total population</th>
<th>Total area in Km²</th>
<th>Population Density</th>
</tr>
</thead>
<tbody>
<tr>
<td>Akaki Kaliti</td>
<td>201,721</td>
<td>.0662</td>
<td>118.08</td>
<td>1,708</td>
</tr>
<tr>
<td>Nefas Silk-Lafto</td>
<td>351,967</td>
<td>.116</td>
<td>68.3</td>
<td>5,153</td>
</tr>
<tr>
<td>Kolfe Keranio</td>
<td>477,284</td>
<td>.157</td>
<td>61.25</td>
<td>7,792</td>
</tr>
<tr>
<td>Gullele</td>
<td>297,818</td>
<td>.0977</td>
<td>30.18</td>
<td>9,868</td>
</tr>
<tr>
<td>Lideta</td>
<td>224,471</td>
<td>.0736</td>
<td>9.18</td>
<td>24,452</td>
</tr>
<tr>
<td>Kirkos</td>
<td>246,194</td>
<td>.0806</td>
<td>14.62</td>
<td>16,840</td>
</tr>
<tr>
<td>Arada</td>
<td>235,363</td>
<td>.0772</td>
<td>9.91</td>
<td>23,750</td>
</tr>
<tr>
<td>Addis Ketema</td>
<td>138,989</td>
<td>.0932</td>
<td>7.41</td>
<td>38,351</td>
</tr>
<tr>
<td>Yeka</td>
<td>385,775</td>
<td>.127</td>
<td>85.98</td>
<td>4,487</td>
</tr>
<tr>
<td>Bole</td>
<td>343,856</td>
<td>.113</td>
<td>122.08</td>
<td>2,817</td>
</tr>
<tr>
<td>Addis Ababa (Total)</td>
<td>3,048,631</td>
<td>1.000</td>
<td>540</td>
<td>5,646</td>
</tr>
</tbody>
</table>

3.2 Research Design and Sampling

Both primary and secondary date were collected for the study through literature review, on-site observation and structured interview. Literature review was conducted at the outset of the research to establish theoretical background about infrastructure accessibility in the urban setting and to gather secondary data pertaining to the situation of Addis Ababa.
The literature review is used to develop data collection instruments that are structured interview and on-site observation. The research involved both qualitative and quantitative methodologies where structured questionnaire was used to acquire quantitative data and on-site observation was employed to gather qualitative information. Purposive and stratified sampling techniques were employed in the selection of settlement areas and interviewees.

As Addis Ababa is the largest city in the country both in terms of population and size, it is purposely selected to be studied in this research. As indicated in Figure 3.1, the city has ten sub-cities where six of them located at the periphery and the remaining four in the inner part of the city. Five of the sub-cities namely Addis Ketema, Arada, Gullele, Lideta and Kirkos are relatively old neighbourhoods where the new housing settlements are believed to be integrated into the already existing infrastructure system. For this reason, these five sub-cities were not included in this study and the research focused on new public housing settlements in five sub-cities at the periphery of the city. The sub-cities included in the research are Akaki-Kality, Bole, Kolfe-Keranio, Nefas Silk-Lafto and Yeka.

![Figure 3.1](image)

Figure 3.1 Administrative map of Addis Ababa city and its sub-cities

4. RESULTS AND DISCUSSIONS
4.1 Interview Results

Before the final interview survey was conducted, a pilot survey was carried out in Mekanisa housing settlement to test the interview instrument. After the instrument was refined actual data collection was conducted in five new housing settlements. 94 respondents participated and provided complete answers to the interview questions. Of the total 94 respondents 65 (69.1%) of them were females and the remaining 29 (30.1%) respondents were males. Responses of the residents concerning the accessibility of infrastructure services is presented in the subsequent sub-sections.

4.1.1 Health Facilities

<table>
<thead>
<tr>
<th>Item</th>
<th>Rating</th>
<th>Frequency (n)</th>
<th>Percent (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accessibility of the nearest health care system in the area</td>
<td>Very satisfied</td>
<td>14</td>
<td>14.9</td>
</tr>
<tr>
<td></td>
<td>Medially satisfied</td>
<td>76</td>
<td>80.9</td>
</tr>
<tr>
<td></td>
<td>Not satisfied</td>
<td>4</td>
<td>4.2</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>94</strong></td>
<td><strong>100</strong></td>
</tr>
<tr>
<td>Type of health care facility used by the residents</td>
<td>Private</td>
<td>30</td>
<td>31.9</td>
</tr>
<tr>
<td></td>
<td>Public</td>
<td>2</td>
<td>2.1</td>
</tr>
<tr>
<td></td>
<td>Both</td>
<td>62</td>
<td>66.0</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>94</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

4.1.2 Drinking Water Supply

<table>
<thead>
<tr>
<th>Item</th>
<th>Rating</th>
<th>Frequency (n)</th>
<th>Percent (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accessibility of tap water service</td>
<td>Satisfied</td>
<td>42</td>
<td>44.7</td>
</tr>
<tr>
<td></td>
<td>Not satisfied</td>
<td>52</td>
<td>55.3</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>94</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

4.1.3 Electric Power Service

<table>
<thead>
<tr>
<th>Item</th>
<th>Rating</th>
<th>Frequency (n)</th>
<th>Percent (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accessibility of electric power supply</td>
<td>Very good</td>
<td>50</td>
<td>53.2</td>
</tr>
<tr>
<td></td>
<td>Satisfying</td>
<td>35</td>
<td>37.2</td>
</tr>
<tr>
<td></td>
<td>Unsatisfactory</td>
<td>9</td>
<td>9.6</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>94</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

4.1.4 Educational Facilities
### 4.1.5 Solid Waste Disposal System

<table>
<thead>
<tr>
<th>Item</th>
<th>Rating</th>
<th>Frequency (n)</th>
<th>Percent (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accessibility of solid waste disposal system</td>
<td>Very satisfied</td>
<td>3</td>
<td>3.2</td>
</tr>
<tr>
<td></td>
<td>Medially satisfied</td>
<td>26</td>
<td>27.7</td>
</tr>
<tr>
<td></td>
<td>Not satisfied</td>
<td>65</td>
<td>69.1</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>94</td>
<td>100</td>
</tr>
<tr>
<td>Pollution due to garbage bins</td>
<td>Yes</td>
<td>79</td>
<td>84.0</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>15</td>
<td>16.0</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>94</td>
<td>100</td>
</tr>
</tbody>
</table>

### 4.1.6 Public Transportation Infrastructure

<table>
<thead>
<tr>
<th>Item</th>
<th>Rating</th>
<th>Frequency (n)</th>
<th>Percent (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accessibility of public transportation system</td>
<td>Very satisfied</td>
<td>3</td>
<td>3.2</td>
</tr>
<tr>
<td></td>
<td>Medially satisfied</td>
<td>49</td>
<td>52.1</td>
</tr>
<tr>
<td></td>
<td>Not satisfied</td>
<td>42</td>
<td>44.7</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>94</td>
<td>100</td>
</tr>
<tr>
<td>Time spent on a transport by the respondent on average daily</td>
<td>30 minutes</td>
<td>4</td>
<td>4.3</td>
</tr>
<tr>
<td></td>
<td>An hour</td>
<td>50</td>
<td>53.2</td>
</tr>
<tr>
<td></td>
<td>2-3 hours</td>
<td>26</td>
<td>27.7</td>
</tr>
<tr>
<td></td>
<td>other</td>
<td>14</td>
<td>14.9</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>94</td>
<td>100</td>
</tr>
</tbody>
</table>

### 4.1.7 Market and Recreational Facilities
### Item Rating Frequency (n) Percent (%)

<table>
<thead>
<tr>
<th>Item</th>
<th>Rating</th>
<th>Frequency (n)</th>
<th>Percent (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accessibility of marketing facility</td>
<td>Very satisfied</td>
<td>14</td>
<td>14.9</td>
</tr>
<tr>
<td></td>
<td>Medially satisfied</td>
<td>61</td>
<td>64.9</td>
</tr>
<tr>
<td></td>
<td>Not satisfied</td>
<td>19</td>
<td>20.2</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>94</strong></td>
<td><strong>100</strong></td>
</tr>
<tr>
<td>Availability of green area or park</td>
<td>Available</td>
<td>53</td>
<td>56.4</td>
</tr>
<tr>
<td></td>
<td>Not available</td>
<td>41</td>
<td>43.6</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>94</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

### 4.2 On-site Observation

The on-site observations made on each site corroborated the results of the interviews. During the on-site observation, it has been found out that there is a critical surface drainage problem in most sites.

### 4.2 Discussion

The results of the interview survey showed that residents participated in the survey have a very low level of satisfaction with provision of solid waste disposal services. This is attested by the on-site observation part of the research. As indicated in Table 2 most residents are not satisfied with the accessibility of most of the infrastructure services provided to them. According to the respondents, accessibility of Electrical and health services are relatively satisfactory. As the density of these public housing settlements is very high, inaccessibility of wastage removal services might affect lives of many if the issues is not addressed urgently.

#### Table 2 Summary of the interview results

<table>
<thead>
<tr>
<th>Infrastructure Service</th>
<th>Frequency</th>
<th></th>
<th></th>
<th></th>
<th>Weighted Average</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Satisfied (weight = 3)</td>
<td>Medially satisfied (weight = 2)</td>
<td>Not satisfied (weight = 1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electricity</td>
<td>50 (53.2%)</td>
<td>35(37.2%)</td>
<td>9(9.6%)</td>
<td>2.44</td>
<td></td>
</tr>
<tr>
<td>Health</td>
<td>14 (14.9%)</td>
<td>76(80.9%)</td>
<td>4(4.2%)</td>
<td>2.11</td>
<td></td>
</tr>
<tr>
<td>Education</td>
<td>6 (11.6%)</td>
<td>31(59.6%)</td>
<td>15 (28.8)</td>
<td>1.83</td>
<td></td>
</tr>
<tr>
<td>Tap water</td>
<td>42(44.7%)</td>
<td>-</td>
<td>55 (55.3%)</td>
<td>1.89</td>
<td></td>
</tr>
<tr>
<td>Transport</td>
<td>3(3.2%)</td>
<td>49 (52.1%)</td>
<td>42 (44.7%)</td>
<td>1.59</td>
<td></td>
</tr>
<tr>
<td>Solid Waste</td>
<td>3 (3.2%)</td>
<td>26(27.7)</td>
<td>65 (69.1%)</td>
<td>1.34</td>
<td></td>
</tr>
</tbody>
</table>

### 5. CONCLUSIONS AND RECOMMENDATIONS
To alleviate housing shortages in Addis Ababa, the city administration together with other governmental and non-governmental organization launched a massive housing development program in the year 2004. Since 2004 more than 100,000 condominium units have been constructed and transferred to beneficiaries. Evidently these new urban settlements and extensions have played a notable role in alleviating housing shortages in Ethiopia. This solution would be long lasting only if these new settlements and urban extensions are provided with adequate infrastructure.

This study has indicated that residents are not satisfied with the accessibility of solid waste disposal, transport, tap water and education services. According to the survey health and electricity infrastructure services are medially satisfactory. On-site observations have revealed that surface drainage poses a considerable problem during wet seasons.

As provision of basic infrastructure rests on the shoulders of the Government, it is inevitable that the Government should focus on Solid waste disposal, transport, tap water and educational services to make the new settlements sustainable.

ACKNOWLEDGEMENT

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A phenomenological study of critical challenges to effective statutory adjudication implementation

Mewomo, M. C. and Prof. Maritz, M. J.
modupemewomo@yahoo.com; 0744870101.
tinus.maritz@up.ac.za; +27-124202581.
Department of Construction Economics, University of Pretoria,
South Africa.

ABSTRACT AND KEYWORDS

Purpose
This paper presents the outcomes of data analysis of experts' perceptions on the critical challenges to effective statutory adjudication implementation. The paper further highlights the causes and consequences of the identified challenges, and finally presents a suggested approach to prevent the identified challenges.

Design/methodology/approach
The conduct of the qualitative interview followed Patton’s general interview guide principles and was carried out in accordance with the phenomenological approach through the use of Skype interviews with adjudication experts from the United Kingdom, Australia, Singapore and Malaysia.

Findings
The study reveals that the effective implementation of statutory adjudication could be threatened when there are challenges. Seven categories of challenges were identified in the study and the possible means of avoiding the identified challenges were also suggested.

Practical implications
Arising from the findings, the application of proposed means of avoiding the identified implementation challenges would positively lead to the effective operation of statutory adjudication practice in the South African construction industry.
Value
The avoidance strategies proposed from the study will ensure cheap and quick resolution of construction disputes through the use of statutory adjudication mechanism in the SA construction industry.

Keywords: Statutory adjudication, legislation, implementation challenges

1. INTRODUCTION

The challenges and frustrations associated with litigation and arbitration in resolving construction disputes have necessitated an increased demand for alternative dispute resolution (ADR). This demand has triggered the introduction of adjudication into the construction industry as a cheap and quick means of resolving construction disputes. Ameer Ali, (2015) identifies default payment (either in form of delayed payment or non-payment) and costly, protracted disputes as two chronic problems plaguing the construction industry. These problems have become so critical that to date, sixteen jurisdictions around the world (England and Wales, Scotland, Northern Ireland, New South Wales, Victoria, New Zealand, Queensland, Isle of Man, Western Australia, Singapore, Northern Territory, Tasmania, Australian Capital Territory, South Australia, Malaysia and Ireland) have introduced legislation on payment and also provided for adjudication as a rapid dispute resolution method to help overcome these problems (Coggin and Bell, 2015). While in general the security of payment regimes could be considered as effective, it was discovered that some inherent problems are found as critical lacunae impeding the effectiveness of the legislations in some of these jurisdictions (Munaaim, 2012; Agapiou, 2011). For instance, the UK Housing Grants, Construction and Regeneration Act 1996 (HGCRA, 1996) underwent amendment in 2011 after approximately 15 years of its existence. Similarly, the Building and Construction Security of Payment Act 1999 (BCSPA) of NSW was also amended in 2002 due to some problems which initially threatened the policy objectives of the legislation (Munaaim and Capper, 2013).

Recently, the Building and Construction Payment Act of Queensland was reviewed and reformed in order to overcome certain challenges to its effectiveness (Wallance, 2013). In fact, the power to appoint adjudicators in Queensland has recently been restricted to the Adjudication Registry as against the initial practice of multiple authorised nominating authorities’ involvement in the process of nomination (Wallance, 2013). Thus, learning from these jurisdictions can help to produce informed decision and direction on how best the effectiveness of statutory adjudication in the SA construction industry could be achieved. This paper therefore investigates the critical challenges to effective statutory adjudication implementation and presents a suggested approach to prevent the identified challenges.
2. POLICY IMPLEMENTATION CHALLENGES

The expectation of every policy-maker is to see that the purpose of making policies is realised on target beneficiaries and a desired result achieved. However, implementation problems do occur and create a gap between policy conception and outcome. Globally, reported gaps between the formulation and outcome of policies, especially in the built environment and urban-regional development, are not a new phenomenon (Muller, 2015). Regrettably, the gap between the policy creation and result often leads to frustrations when planned goals are not achieved. Thus, it has been realised that whenever enabling factors that are critical to efficient implementation of policies are missing, implementation problems are always inevitable. Edwards and George (1980) as cited in Makinde, (2005) identified four critical factors to be considered if implementation problems are to be avoided. These factors are (i) communication, (ii) resources, (iii) attitudes and (iv) bureaucratic structure. Makinde (2005) opines that these factors interact with each other and operate simultaneously to either impede or aid an effective implementation process. In the same vein, Nah and Delgado (2006) emphasised four factors which are (i) strong commitment, (ii) open and clear communication, (iii) leadership, and (iv) empowered implementation team as necessary antecedents to a successful implementation.

According to Cartwright (2015) there exist systemic problems which make the gap between policy theory and practice hard to close. It is therefore important to recognise systemic sources of trouble and design the ways to cope with the gap through planning prediction, planning decision, monitoring and provision of fall-back and failsafe plans.

3. RESEARCH METHOD

This study adopted a qualitative research approach informed by the interpretivist philosophical assumption. Data were collected through interviews in accordance with the phenomenological approach (Flick, 2014; Groenewald, 2004) and the conduct of the qualitative interview followed Patton’s (1990) general interview guide principles. Fifteen experts from four selected jurisdictions participated in the research and the interviews were conducted via Skype. An acceptable sample size for interviews is from 5 to 25 individuals (Leedy and Ormrod, 2009; Bertaux, 1981; Creswell, 1998; Morse, 1994).

The participants were selected through purposive/judgemental sampling technique. The choice of purposive sampling method was based on the recognition of the fact that it is the most important kind of non-probability sampling to identify suitable participants who have had experience relating to the phenomenon under consideration (Kruger, 1988). Thus, using the phenomenological approach allows the researcher to collect information from experts who have direct experience with the phenomenon under consideration. Accordingly, the data were collected
from recognised professionals that were directly involved in adjudication implementation in the United Kingdom (UK), Australia, Singapore and Malaysia. The selected participants are regarded as experienced and leading adjudicators in their countries. Most of these participants have more than twenty years of experience, and have engaged in adjudication as legal advisers, legal representatives and construction lawyers. In addition, some of the participants have also written books and journal articles on adjudication and payment legislation in their countries and internationally.

The interview guide approach was employed to elicit information from the participants. The interview guide was developed to enable uniformity in the manner at which questions are asked throughout the interview exercise and also to facilitate consistency in the trajectory of the interviews. The interview guide comprised of eleven open-ended questions, excluding demographic questions. The questions were to probe the individual’s viewpoint regarding the subject matter and the structure of the questions allowed reciprocal two-way communication arrangement with the interviewees’ thereby giving room for exploratory and clarification purposes (Thomas, 2004). The interview lasted on average thirty eight minutes. With the kind permission of the interviewees, the interviews were audio-recorded and the recordings were transcribed thereafter.

The thematic analysis of data was based on general principle of qualitative analysis, in an attempt to comprehend interviewees’ contributions on effective adjudication practices (Strauss & Corbin 1998; Tuckett, 2004). The analysis followed the qualitative principle of analysis which include: transcribing, coding and constant comparison. The process was done manually by the researcher for the purpose of getting comprehensive ideas of the data. During this process, key ideas were identified and highlighted. Thereafter, the transcribed data were coded, then the coded data were categorised and relationships were built among the categories. The three identified themes under this study comprise: teething problems and critical challenges to effective statutory adjudication implementation; causes of teething problems and critical challenges to effective implementation; and avoidance strategies and preventive measures to adjudication implementation challenges. The data from the study were validated by employing the principle of trustworthiness and authenticity established for qualitative research.

4. RESEARCH FINDINGS

4.1 Theme 1: Critical challenges to effective statutory adjudication implementation

The first theme is focused on the teething problems and critical challenges that could impair the effectiveness of statutory adjudication process. Based on the analysis of the interview data, the majority of the participants noted that the existence of statutory adjudication has largely improved cash-flow
and dispute resolution process within the construction industry. In addition, the interviewees assert that, although these statutory interventions are viewed to be generally successful, their effectiveness could be undermined when there are challenges. Thus, the interviewees identified several challenges that could impair the effective implementation of the legislation.

The challenges identified are grouped under seven categories namely: (i) challenges relating to change process; (ii) challenges relating to technical provisions and contents of the legislation; (iii) challenges relating to the issue of procedure and process; (iv) challenges relating to legal technicalities; (v) challenges relating to cost of adjudication and adjudicator’s fees; (vi) capacity challenges; and (vii) jurisdictional challenges.

**Challenges relating to change process issues**

The challenges relating to change process refer to the teething problems or difficulties that arise during the initial stages of the implementation process. The data analysis revealed that, industry's slow acceptance of the legislation, ignorance about the provisions of the legislation and the failure to understand the requirements of the new Act, lack of understanding by the users, users’ ignorance of their entitlement under the new Act, lack of awareness and low level of knowledge of the legislation were identified as change process challenges. These teething troubles are viewed by the participants as potential factors that could undermine the effectiveness of the Act if not properly handled.

Participant 7 from Australia explained that: “The two most significant reasons for the teething problems are: lack of training/understanding by users, adjudicators, lawyers etc. and drafting inconsistencies within the legislation”. In line with participant 7 submission, participant 9 from Singapore also noted that: “Teething problems also arose in the way Acts were drafted and the technical provisions in the Act”. The perception from the interviewees’ comments is that, where these challenges exist, the usability and the level of invocation of the legislation may be low.

**Challenges relating to technical provisions and contents of the legislation**

More than ten of the participants independently observed that problems relating to the contents of the Act are critical. According to the views expressed by the participants, challenges relating to the technical provisions and contents of the Act usually arise when there is a lacuna in the legislation. It was revealed from the analysis that the manner in which a particular legislation is drafted has a way of influencing the outcome of that legislation. The majority of the interviewees stressed that drafting inconsistencies and ambiguities in legislation have led to critical interpretation problems in many jurisdictions.

According to participants 6: “The major teething problem, in my view, is the interpretation of some of the provisions of the Act and this has to be sorted out by the High Court. To date, there are more than 15 cases that have been referred to the High Court”.

Similarly, participant 2 is of the view that there would always be confusion whenever the Act is silent on how some issues should be carried out. According to her, the way the act is worded can influence the interpretation and understanding of the contents of the legislation. Gaps/lacunae in the legislation, or when the Act is silent on some issues will definitely result in a condition which may undermine the legislation’s effectiveness. The implication of the views expressed above is that challenges relating to the content and technical provisions of the Act give rise to uncertainty on some important issues within the Act. This will not only undermine the effectiveness of legislation but increase litigation.

**Challenges relating to issue of procedure and process**

The challenges identified from the interviews under these categories are mainly (i) ignorance of subcontractors, suppliers, etc. of the various provisions of the Act, and their entitlements under the Act, (ii) procedural complexity and (iii) the level of accessibility. One particular interviewee explained that one contributing factor to the procedural challenges is that the Act provides only a general framework but provides no detailed procedure as to how and what to do.

**Legal technicalities challenges**

The opinion of the interviewees on what constitutes legal technicalities challenges include: (i) the strict interpretation of the rules of adjudication, (ii) the introduction of complicated issues that is applicable to arbitration, and (iii) adverse court decisions. Participant 9 explained that lawyers tend to approach adjudication with a strict interpretation of the rule of adjudication. This has actually resulted in many technical breaches thereby giving room for applications to be rejected. In some situations, good claims are dismissed due to technical breaches. This has not only been a waste of time and resources, but also a failure of claimants to meet the justice of the claim when a good claim is dismissed due to technical breaches of the Act. Adverse court decisions have their share in defeating the objective of the legislation. Participant 7 explained that: *the courts’ decisions which nullify the effect and efficiency of how adjudication is intended to operate can stultify the significance of adjudication and bring the system to a standstill, thereby circumventing the objects of the legislation.*

**Challenges relating to cost of adjudication and adjudicator’s fees**

The challenges relating to issues of cost and fees are viewed from two perspectives. On one hand, a large proportion of the interviewees agreed that if the cost of adjudication is excessively high, this may be a limiting factor to its wider usage and thus affect the impact of the legislation. In this regard, one of the interviewees with considerable experience explained that the excessive cost of adjudication may be a significant barrier to subcontractors in pursuing adjudication. On the other hand, two interviewees raised concern that, if the adjudicators’ fees are too low, it could discourage the experienced adjudicators and lead to inadequate
capacity, as they (referring to experienced adjudicators) may not want to practice adjudication.

**Capacity challenges**
The issue of quality is fundamental to an effective adjudication process. The analysis of the interview data revealed that capacity challenge could come in the form of: (i) Inadequate resources in terms of number of adjudicators available to kick-start the adjudication process; (ii) Inadequate resources in terms of the quality of the available adjudicators; and (iii) Inadequate resources in terms of the discipline and experience of the available adjudicators.

Some of the interviewees believe that, for an adjudication regime to be successful, it requires highly experienced adjudicators that can produce quality decisions. This implies that the quality of decisions produced by such adjudicators is likely to be high, and unlikely to be reopened at other levels of dispute resolution, such as arbitration and litigation. Some of the interviewees also believe that when there is availability of adequate capacity, then careful assessment of which adjudicator is available and can deal with the complexities of a particular case would be possible. Thus, matching the right sort of adjudicator with the right sort of dispute would not be too difficult.

**Jurisdictional challenges**
Data analysis reveals that the implementation of the Act has become too legalistic with numerous jurisdictional challenges and applications for stays/setting-aside of adjudication decisions. Further, it was discovered that there are many grounds on which a jurisdictional challenge might be brought into adjudication. The grounds for challenging an adjudicator’s determination include jurisdictional errors by the adjudicators, or breach of natural justice. It was also discovered that in some situations where the agreement to adjudicate is not in writing, or where one of the parties feels that the adjudicator was not validly appointed, or when a party feels that he has not been given a fair hearing cause jurisdictional challenges. This challenge, according to the participants, defeats the very objective of the Act of making adjudication a summary, simple, fast and relatively cheap process.

**4.2 Theme 2: Causes of teething problems and critical challenges to effective implementation**

The interviewees provided a lot of information on the various causes of implementation challenges. These include: (i) poor drafting style and drafting inconsistency within the legislation; (ii) unnecessary judicial interference or adverse court involvement in the adjudication process; (iii) ignorance or lack of familiarity with the process and procedure; and (iv) lack of clarity on the provisions of the legislation (ambiguities)
As revealed by the data, the drafting inconsistencies within the legislation provide a basis for interpretation problems with parts of the legislation. One of the participants observed that the ambiguities within the legislation have led to considerable confusion in pursuing the contractual remedies stated in the legislation. In addition, some of the interviewees observe that failure by the court to understand the intended nature of adjudication had in some instances led to adverse interpretation and setting aside of adjudication decisions. In fact, this action had in some instances resulted in a flood of jurisdictional challenges. Thus, it was observed that the losing party in adjudication may use this avenue to challenge the adjudication determination with the hope of delaying or avoiding payment to the winning party.

The interviewees also observed that the user’s (contractors/subcontractors) low level of knowledge, users’ ignorance of the legislation provision and degree of accessibility to the legislation are the factors that are responsible for some of the problems associated with the implementation process.

4.3 Theme 3: Avoidance strategies and preventive measures to the identified implementation challenges

The participants suggested certain strategies that could be used as a measure to prevent various challenges identified in this study. Some of the suggested preventive measures include: raising awareness of different construction stakeholders through different means, such as road shows, seminars, workshops and conferences etc. In addition, education and training was suggested as one of the significant factors that can enhance effectiveness. Some of the participants advised that the high court judges should be educated about the intended nature of adjudication in order to avoid any misconception in relation to statutory adjudication objective. Participant 12 noted that: “I think, it is by creating awareness in the judges of how arbitration is different from adjudication. It will be good for the judges to be involved in the consultation process as well, so that the judges may be well informed of what adjudication is and what the legislation wants to achieve when it is introduced in the future. Thus, it will be good to create and increase awareness to let the judges be involved from the very beginning”. The implication of the statement of participant 12 is that all industry stakeholders, that would be involved in adjudications whether as a user or as implementer, should be properly educated.

Some interviewees also suggested that institutional interventions will go a long way in preventing the identified challenges. These interventions include: (i) the regulation of adjudication fees, (ii) information dissemination and (iii) maintaining a high standard of adjudicators through the introduction of a quality control system and rigorous training and assessment programmes.
5. DISCUSSION
As previously noted, challenges are not uncommon to an implementation process. Every policy maker expects to see that the policy objectives behind their legislation is achieved. However, implementation problems do occur and create a gap between policy conceptions and outcomes. While it has long be recognised that the existence of systemic problems usually make the gap between policy theory and practice hard to close (Cartwright 205), the lack of adequate preparatory arrangements to influence transformation initiatives and implementation process usually compounds implementation problems.

As indicated in this study, one of the major challenges to effective implementation is the degree of ambiguity of the policy. The challenge of ambiguity consequently leads to diverse interpretation, multiple perspectives and interpretative flexibility (Moncaster and Simmons, 2015). These challenges have in some instances led to jurisdictional challenges, rejection of adjudication determination and thus defeat the purpose of the legislation to provide quick and cheap resolution process.

Again, the lack of awareness and insufficient knowledge of the new legislation, procedural complexity, low level of accessibility, lack of understanding of the contents of the legislation, inadequate information dissemination, insufficient resources, unavailability of the required combination of resources, lawyer attitudes, and excessive high cost of adjudication were recognized as potential impediments to the effective implementation of the legislation. All these require adequate attention if the purpose of introducing the legislation is to be achieved. Thus, Kennedy (2008) was of the opinion that, in the context of the adjudication process, there are several threats to its survival, or, at the very least, for adjudication’s continued good health. In line with this view, the requirements for effective statutory adjudication implementation and sustainability should become a crucial issue to the construction stakeholders.
6 CONCLUSION
This paper has explored the teething problems and critical challenges that could threaten the effectiveness of adjudication as an ADR process based upon a qualitative interview involving experts drawn from the UK, Australia, Singapore and Malaysia. The paper has highlighted challenges that have to be surmounted in order to achieve the pragmatic functionality of legislation supporting statutory adjudication. The phenomenology study revealed several challenges that can undermine the effectiveness of statutory adjudication in the resolution of construction disputes. Challenges relating to the contents of the legislation was identified as one of the most critical challenges that usually cause inefficiency in the implementation process. It was also discovered that drafting inconsistency (legislation content issues), unnecessary interference and ignorance are additional factors that can occasion failure in the implementation process. Thus, the participants offered possible ways to prevent the identified challenges and this findings lead to the conclusion that, if priority is given to proper drafting of the legislation in a clear, simple and understandable manner, and the issues of ignorance is dealt with through rigorous publicity and creation of awareness, adjudication becoming the most effective dispute resolution in the SA construction industry has great possibilities.

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Wallance, A. 2013, Discussion paper – Payment dispute resolution in the Queensland building and construction industry (Final report of the review of the discussion paper-payment dispute resolution in the Queensland building and construction industry).
An Exploratory study of the Assessment practices in Construction Undergraduate Education in South Africa

Ephraim Zulu and Theodore C. Haupt
zulue@ukzn.ac.za, haupt@ukzn.ac.za
Construction Studies, School of Engineering, College of Agriculture, Engineering & Science. University of KwaZulu-Natal, King George V Avenue, Durban, 4041, South Africa. Tel.: +27312602687

ABSTRACT AND KEYWORDS

Purpose of this paper
This paper presents an exploratory study on factors underpinning current assessment practices in construction higher education in South Africa.

Design/methodology/approach
An extensive literature review was carried out on assessment. A mixed approach was used through questionnaires given to construction lecturers. This was supported through semi structured interviews with the construction lecturers as a focus group during a 3 days seminar at University of KwaZulu-Natal, Durban, South Africa.

Findings
From literatures and the qualitative and quantitative analysis of the responses from the focus group, it is clear that assessment can be used both to evaluate learners outcomes and to support learners’ learning to produce construction graduates that are well equipped to face the challenges in the 21th century..

Research limitations/implications
The research is limited because the findings are based on findings from existing literatures and they were collaborated by physical research of a small focus group.

Practical implications
This study examines the role of assessment in learner’s learning. It evaluates the current assessment practices used in construction education in South Africa and outlines possible competencies and skills that should
be taken into consideration for the effective assessment of the learning outcome of any construction Programme.

**What is original/value of paper.** Competent construction graduates in South Africa can be produced through effective assessment strategies which cater for the ability of learners to develop synthetical and critical ways of thinking

**Keywords:** Assessment, Learning, Quality Assurance, Critical-Thinking, Learning Outcome, Assessment Triangle.

1. **INTRODUCTION: ASSURING THE QUALITY OF UNDERGRADUATE TEACHING**

The thought of how to improve the quality of education has been the most influential ‘meta-idea’ in higher education for almost two decades (Stensaker, 2007). The quality of teaching and learning in higher education institutions is being closely examined as a result of the increase in the cry for quality assurance and accountability (Byrne and Flood, 2003). Recently, developed countries like Australia, United States and United Kingdom have also developed instructional policies that are addressing the demand placed on higher education as a result of massification and globalisation. Massification is a term used to describe the swift growth in student enrolment witnessed towards the end of the 21st century in higher education. The massification of education in Southern Africa in general and South Africa in particular also has a moral dimension. It was also meant to address or respond to the past historical inequalities the country had experienced. Higher education of learning now opens its door to previously disadvantaged black and the working class communities so there is need for the system to be flexible, open, transparent and responsive to the needs of the people. The changes in global economy, knowledge production and workplace have implications on the expectation of the employer. Employers now prefer graduates with the ability to learn and have transferable generic skills more than subject knowledge.

In South Africa, the need to accommodate all these changes has led to the introduction of new policies relating to the accreditation of qualifications through a National Qualification Framework (NQF). These policy and socio-economic contexts have a great effect on the appropriate assessment used in higher education. Among other things, these polices looked at assessment issues like: the introduction of assessments practices that recognise different learning and life experiences that is prior learning; the importance of assessing generic skills and relevant knowledge in uncommon work contexts to make learners relevant in the present world of work; investigation of learners’ capabilities to integrate
skills and knowledge from different discourse and discipline; the production of learner’s that are self-reflexive and lifelong learners; encouraging working in groups through the introduction of group work and peer-assessment; shifting to outcomes-based curriculum from content-based; and the use of multiple assessment methods and tools (Luckett and Sutherland, 2000).

According to Clark (2003) ‘Assessment is one of the most powerful drivers of innovation and change in education, as it defines the goals for both learners and teachers.’ It plays a major role on how learners learn and it is also linked to effective learning and teaching because it is used to reward achievement and understanding (Brown and Glasner, 1999). This is in agreement with Benevides (2011) statement which state that ‘Successful learners most often rely on assessment deadlines and activities to both pace and direct their learning efforts. Effective teachers use assessment activities strategically to motivate learners to engage successfully in productive learning activities.’ So the strategic use of assessment for either formative or summative purpose should be able to motive learners to learn. Formative assessment which is assessment for learning should be carried out regular and it should provide learners with advice and guidance for progressive learning while summative assessment is an ‘end of learning event’ when assessment of learning is carried out. However the use of assessment as the extrinsic motivator for learning can lead to learners adopting surface approach techniques of leaning (Bull et al., 2002).

This article looks at how assessment, at various levels of strategy and practice is now being addressed and administered through the scholarship of a focus group of staff in higher education (academics, researchers, learning technologists and educational developers).

2. RATIONALE UNDERPINNING EFFECTIVE ASSESSMENT IN HIGHER EDUCATION

The motivation and importance of effective assessment in higher education have always been generally explored (Race, 1996). Several reasons were identified, some of which are: measuring achievement; diagnosis; providing feedback; evaluation of progress; motivation; demonstration of the acquisition of skills; and demonstration of competencies. It is clear that all these expectations cannot be met with the use of just one assessment tool or method so it is suggested that multiple methods of assessment should be used to meet the various assessment expectations (Brown and Knight, 1994). They also believed that learners should experience various forms of assessment within a programme during a study.

According to Brown et al. (2004) ‘Assessment that is ‘fit for purpose’ uses the best methods of assessment appropriate to the context, the students, the level, the subject and the institution.’ The emergence of new innovations in assessment practice supported by various educational
agencies all over the world notwithstanding there is still the continuous use of a culture of traditionalism in many universities. According to Brown et al. (2004), 80% of the assessment in universities are based on the following assessment tools: examinations; essays; and report writing but this is one of the factors preventing the development of innovative assessment principles (Buswell, 2002). The rising concerning on plagiarism and the use of different forms of ‘dishonesty in assessment’ have been the main driving force agitating for the use of innovative assessments in higher education (Larkham and Manns, 2002) coupled with the importance derived from the use of good practices which involves getting feedbacks from learners (Cantwell, 2002).

3. ASSESSMENT AND LEARNING IN CONSTRUCTION EDUCATION

In research communities and educational practice, assessment is often seen by many individuals as having negative effects on teaching and learning especially if high stake is attached to the outcome of the assessment results (Linn, 2011; Kaestle, 2013). Assessment is an effective learning and teaching tool in construction education if it is properly conceived, designed, and implemented. Construction programs around the world have incorporated many different types of learning in their curricula as a way to increase the development of critical and synthetic thinking of learners and graduates because it is the foundation of professional practice. Yet there is no or very little research on how these efforts have succeeded or failed. There was a general impression—eventually confirmed by data—that the capacities of learners to think critically and synthetically were not being properly developed by existing curricula (assessment) or methods of instruction. Assessment could have a positive influence on attaining the learning goals expected of construction graduates in the 21st century. It is very important that the use of any innovative assessments method should be well align with actual learning, this should also be in alignment with the desired learning outcomes for that particular module (Gibbs, 1999). It is also important that the assessment should be able to identify if learners are able to apply, analyse and critically reflect on what they have learnt and not just the ability to memorize what they are taught (Nicholls, 2002). This strategy would encourage learners to adopt deep approach to learning rather than using the surface approach to learning. It cannot be over emphasis that assessment plays a major role in teaching and learning (Uden, 2006). According to Ramsden (1992), learners see their assessment as the curriculum. This is because most often learners only study what they think they will be assessed on and not what they were taught or what is in the curriculum so it is important to use the assessment to reflect the intended learning outcomes (Biggs, 2003). Figure 3.1 illustrate how both the teacher and learners views assessment.
According to Pellegrino (2014) learners acquire knowledge and skill from reasoning with the evidence received as data from marks on answer sheets, assignments, written essays, presentations of projects and other assessment related issues. This process of reasoning is regarded as the assessment triangle. The vertices of the assessment triangle (see Figure 3.2) represent the three key elements underpinning a typical assessment which are 1) Observation - This is based on a set of principles and assumptions that will provide relevant evidence of learners' competencies. Assessment should prompt learners to do, say, or create something that demonstrates important knowledge and skills since it linked to the cognitive model of learning which illuminate the responses from learners. 2) Interpretation – The interpretation of the evidence in line with the purpose of the assessment and how the learners understand it, is also another important process. This involves including all the tools and methods used to reason from imperfect observations. It also involves how the observations resulting from a set of assessment tasks constitute evidence about the skill and knowledge being assessed. 3) Cognition - Learner cognition and learning includes theory, data and assumption which represent how learners represent knowledge and develop competence in a particular module. Assessment should be able to identify a theory of learning needed to identify the set of skills and knowledge relevant to be measured in that module for formative or summative purpose.
Every assessment must have the 3 elements during its designed, implementation and evaluation stages. These elements should be dependent and also connected to each other so they are connected as vertices of a triangle. For an assessment to be valid and effective the elements must be in operation simultaneously. The assessment triangle can be used to analyse the underpinnings factors of current assessments to evaluate its effectiveness. It can also be used to design future assessments and checking its validity (Marion and Pellegrino, 2006).

4. METHODOLOGY

The methodology implemented in this study is a convergent parallel mix of qualitative and quantitative research method. The combined use of these methods has the potential to intensify the study and this gave an in-depth understanding of the current assessment practices currently used in construction education programmes South Africa (Fox and Bayat, 2008).

Qualitative research was used in this study because it seeks to understand a given research problem from the viewpoints of the local population it comprises. It is effective in obtaining culturally specific information about the behaviours, opinions, values and social contexts of particular populations. Qualitative studies lay more emphasis on descriptions, experiences, meaning. This approach is also very interactive, dynamic and subjective in nature (Davies and Hughes, 2014). In line with the objectives of this study, a qualitative approach was used to conduct an investigation into the understanding and use of assessment in construction education. A quantitative research approach was used to evaluate the
current assessment practices by analysing the responses which made up of measurable variables from in-depth interviews and a small focus group of construction lecturers. This helped to determine the general opinion of construction studies lecturers on assessment (Creswell, 2013).

The use of both qualitative and quantitative research method in this study gave an in-depth understanding of lecturers’ views on assessment. These approaches was also able to identify the factors underpinning lectures’ perceptions of assessment (Leedy and Ormrod, 2010). The data collected included numeric data like class size and pass rate and personal beliefs and views on assessment. The main instruments used for data collection were questionnaire and semi-structured interview questions. The questionnaire was administered on a small focus group of construction studies lecturers during a seminar organized by Property Development department at UKZN in June 2016. Few of the delegates at the seminar were also interviewed to get a clearer and more personal experience of their current assessment practices. The questionnaire was design to investigate the factors underpinning the usage of different assessment methods by construction lecturers. These factors were extracted from literature and included factual knowledge, theory understanding, practice understanding, critical thinking, problem solving, analytical thinking, creative capacity, gaining new knowledge, do independent work, work collaboratively and oral idea presentation.

The data collected in form of responses were analysed to deduce trends and deviations. The data helped to understand the current assessment practice used in construction higher education in South Africa rather than solely relying on the information from literature. Ethical issues were also taken into consideration while conducting this study. The purpose and nature of the survey and study were carefully explained to the participants and participation in the study was made voluntary.

5. RESULTS AND DISCUSSION

On average, the respondents lectured classes of about 67 students on average and ranged from 30 to 120 students implying a fairly large class in most cases. The pass rate for the various classes was 80% on average and ranged from 60% to 90%. The amount of time allowed for assessment by each lecturer varied widely but the relative ratio of formative assessment against the final summative assessment was 40% to 60% because it was dictated by university policy.

Seven distinct assessment types were in use, namely, individual assignments, group assignment, tests, a final exam, mode building, practical work and project work. However, individual assignments, tests and a final exam predominated which is consistent with findings by Brown et al. (2004) that 80% of assessments are based on essays, reports and exams. Brown and Night (1994) recommended using various assessment
methods to meet the various expectations. Lukett and Sutherland (2000) recommended using multiple assessment types. The predominant use of individual assignments, test and exams suggests that some assessment expectations are not being met. Brown et al. (2004) recommended that the best assessment is one that is suited to the student, the level and the subject. The consistent use of the same assessment tools across different modules further suggests that the assessments may not be suited to either the student, the level or the subject. On the other hand, the use assessments such model building for the drawing class and practical work for modules of a laboratory practical nature show some evidence of attempts to suit some assessments to the subject.

Based on the perceptions of the lecturers, assessments which are favourites for students are varied. However, work involving actively doing things the activity other than writing such as presentations, projects, practical work and model building were often favoured. Brown et al. (2004) suggested that assessments should be suited to the students and engaging students in assessment activities which they prefer while bearing in mind the appropriateness to both the level of study and subject may at least motivate the students. However, it is unclear whether the lecturers are actually aware of the assessment activities mostly favoured by students which varied fairly widely while the assessment administered, save for a few very specific instances, were very restricted.

5.1 Assessment Evaluation Aims

Both formative and summative assessments aim to achieve objectives including measuring achievement, diagnosis, providing feedback, evaluation of progress, motivation, demonstration of the acquisition of skills, and demonstration of competencies learned. In order to establish whether lecturers consider these objectives when deciding on the assessment type used, the extent to which the following factors are considered when developing the assessments were investigated.

- Factual knowledge
- Theory understanding
- Practice understanding
- Critical thinking
- Problem solving
- Analytical thinking
- Creative capacity
- Gaining new knowledge
- Do independent work
- Work collaboratively
- Oral idea presentation

Respondents were asked to state whether or not they consider these aims in their assessment design. The results are shown in Tables 5.1, 5.2 and
5.3 show that students doing independent work and gaining a theoretical understanding of the subject were considered by all respondents. Critical thinking, problems solving and collaborative working was considered by more than 80% of the respondents while gaining factual knowledge, gaining new knowledge, practical understanding, creative capacity and oral idea presentation were considered by between 60% and 75% of the respondents. Analytical thinking was considered by less than 40% of the respondents.

**Table 5.1 Assessment Evaluation Aims**

<table>
<thead>
<tr>
<th></th>
<th>Factual knowledge</th>
<th>Theory understanding</th>
<th>Practice understanding</th>
<th>Critical thinking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>75.0%</td>
<td>100.0%</td>
<td>62.5%</td>
<td>87.5%</td>
</tr>
<tr>
<td>No</td>
<td>25.0%</td>
<td>0.0%</td>
<td>37.5%</td>
<td>12.5%</td>
</tr>
</tbody>
</table>

**Table 5.2 Assessment Evaluation Aims**

<table>
<thead>
<tr>
<th></th>
<th>Creative capacity</th>
<th>Gaining new knowledge</th>
<th>Do independent work</th>
<th>Work collaboratively</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>62.5%</td>
<td>75.0%</td>
<td>100.0%</td>
<td>87.5%</td>
</tr>
<tr>
<td>No</td>
<td>37.5%</td>
<td>25.0%</td>
<td>0.0%</td>
<td>12.5%</td>
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**Table 5.3 Assessment Evaluation Aims**

<table>
<thead>
<tr>
<th></th>
<th>Problem solving</th>
<th>Analytical thinking</th>
<th>Oral idea presentation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>87.5%</td>
<td>37.5%</td>
<td>62.5%</td>
</tr>
<tr>
<td>No</td>
<td>12.5%</td>
<td>62.5%</td>
<td>37.5%</td>
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5.2 Objectives of Assessment Questions

Respondents were also asked to state whether or not they considered the following factors when designing their assessment questions.

- a. Revisit learning theory
- b. Thinking for themselves
- c. Connection between old and new learning
- d. Motivate
- e. Explain thinking

The results in Table 5.4 show that more than 87% of the respondents considered revisiting learning theory, students thinking for themselves and making a connection between students’ old and new knowledge learnt. Assessment designed with a view to motivate students was considered by 75% of the respondents while only 62.5% thought about designing assessment questions where students are expected to explain there
thinking. Benevides (2011) observed that effective teachers use assessment to motivate students to engage in productive learning activities which appears to be achieved by some of the respondents. Nicholls (2002) stressed that assessment questions should engage students to apply the knowledge learnt and not just to test their memory. The results in Table 5.4 suggest that most lecturers attempt to assess their students in more than just their memory. This also suggest that the assessment questions are thought out before they are administered to the students which is consistent with recommendations by Pellegrino (2006).

<table>
<thead>
<tr>
<th></th>
<th>Revisit learning theory</th>
<th>Thinking for themselves</th>
<th>Connection between old and new learning</th>
<th>Motivate</th>
<th>Explain thinking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>87.5%</td>
<td>87.5%</td>
<td>87.5%</td>
<td>75.0%</td>
<td>62.5%</td>
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<tr>
<td>No</td>
<td>12.5%</td>
<td>12.5%</td>
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6. CONCLUSION

The scope of this study which include discussions, exercises and reflections are not exhaustive. It is not possible to cover every feature of assessment, but the hope is that this study will make construction higher education practitioners reflect on the pedagogical underpinnings their assessment practices.

There is need to increase the awareness among academic staff on the importance of aligning teaching, learning and assessment as suggested by Biggs (2003). The study was designed to give insights into how construction lecturers view assessment and the relationship between student learning and assessment of student learning. The study reveals that lecturers are assessing their learners based on competencies and skill that like factual knowledge, theory understanding and analytical thinking. Some of the lecturers do not lay emphasis on more important skills like critical thinking and problem solving skills needed in 21st century graduates of construction studies. Incorporating critical thinking and problem solving skills into assessment not only imply producing construction graduates with skills that are currently needed for participation in the construction industry but also to train those graduates to think critically so that they can succeed in the increasingly complex environments and the multiplicity of trends in which the industry operate (Wang et al., 2013). According to Pandor (2007), South African higher education institutions are expected to produce graduates who will contribute to national economic, social and cultural development. They are
also expected to contribute successfully in their respective professional bodies and the global economy. It is believed that these skill and competences can only be achieved through learning assessment processes that involves real life, self-regulated contexts and collaboration (Scheer et al., 2012). The presently used method of instruction or curricula or assessment does not cater for the ability of learners to develop synthetical and critical ways of thinking. It is recommended that new curricula which include new assessment methods constructed around inquiry based learning should be developed and implemented. This will enable the development of problem-solving, integrative and thinking skills and the introduction of new pedagogic methods to meet the present demand of the construction industry. A detailed study of the various components of inquiry based learning is also recommended for further study.

7. ACKNOWLEDGMENTS

The authors would like to thank all the lecturers and everybody that participated in this study for their positive contributions.

8. REFERENCE


Qualitative analysis of supervisory motivational reinforcement techniques enhancing the productivity of construction workers

Alvin Graham Opperman¹, Ruben Ndihokubwayo², Gabriel Nani³

¹,²Department of Construction Management and Quantity Surveying, Cape Peninsula University of Technology, South Africa
³Department of Building Technology Kwame Nkrumah University of Science and Technology, Kumasi

¹MTech student, oppermanag@cput.ac.za, tel. no. +27 21 959 5870
²Lecturer, ndihokubwayor@cput.ac.za, tel. no. +27 21 959 6845
³Lecturer, gabrielnanik@gmail.com

ABSTRACT

Purpose of this paper - The aim of this research is to assess the effect of supervisory motivational reinforcement techniques on construction workers productivity.
Design - A qualitative research approach was employed using a semi-structured questionnaire to interview construction workers including bricklayers, plumbers, concrete workers, electricians and earthworks workers. The interviews were done in Bellville in the Western Cape at two conveniently selected construction companies, registered with the Construction Industry Development Board (CIDB). The data was analysed using content data analysis.
Findings - Most prevalent in the findings of this study is that the workers concurred that a lack of motivational reinforcement techniques negatively impact their productivity. The motivational reinforcement techniques investigated was positive reinforcement and punishment.
Research limitations - This research was conducted within the Western Cape Province of South Africa. Only data from the construction workers and not from the supervisors were obtained.
Value of paper - This research has significance for contractors, supervisors and workers. An increase in productivity of motivated workers results in an increase in contractors’ revenue. Construction supervisors will reflect on their shortcomings in worker supervision, and gain more insight of the supervisory techniques and skills that will boost the productivity of their workers. Workers feel more relaxed in a conducive supervisory
working environment; as a result, the increased productivity leads to financial rewards, and or promotion within their organisation.

Keywords: motivation, reinforcement, supervision, productivity

1. INTRODUCTION

In today’s highly competitive global economy, most organisations are under severe cost pressures which make recognition programmes predominantly attractive. In contrast to most other motivators, recognising a worker’s superior performance often costs little or no money. Consistent with reinforcement theory, rewarding behaviour with recognition instantaneously following that behaviour is likely to encourage its repetition. However, few organisations in South Africa have structured programmes or interventions to reinforce their workforce’s behaviour (Robbins, Odendaal & Roodt, 2006:154).

Motivation is a critical strategy within an organisation, where it is a system that seeks to attract people to join an organisation, to keep them coming to work, and more importantly to motivate them to achieve high levels of performance (Gibson, Donelly & Ivancevich, 2000:191). However, in order to motivate workers to perform within acceptable levels, Uwakweh (2005:314) indicates that supervisors fulfil demanding positions in construction projects because it is expected of them to manage, plan define work, and communicate with workers.

Robbins et al. (2006:143) state that the application of motivation styles and practices from United States of America (where most motivational theories were developed) in South-Africa and in Africa in general, needs to be handled with care. Some in-depth research is required to clarify the moments of truth in each of these theories that can potentially be applied effectively in the Southern-African context (Robbins et al., 2006:143).

There continue to be ample opportunities for future research in what aspect motivational theories can be applied to Southern Africa conditions (Robbins et al., 2006:143). Key among these strategies is communication strategies adopted by supervisors in construction industry to improve productivity of workers. The objective of this study is to determine to which extent motivational communication techniques influences productivity on a construction site.

2. CONSTRUCTION SUPERVISORS

Supervisors take up crucial positions in construction projects, because they are the channel through which management and the workforce do communicate (Uwakweh, 2005:314). Thus, supervisors are regarded to be able to understand human behaviour and administer management principles (Catt & Miller, 1991:13).

According to Dubrin (2005:37), supervisors plan, establish and regulate the project. The supervisor will also assign and utilise resources
within the construction company in the quest of the targets set by the owners. However, supervisors get tasks completed through other people where a supervisor’s elementary responsibility would be to initiate decisions, designate resources, and more importantly direct the tasks of workers to reach company targets (Robbins et al., 2006:84).

Doloi (2007:30) states that in order to improve the construction workers productivity and worker motivational concerns must be determined and investigated. Knowledge of these concerns and the befitting measures aids the construction industry in creating an efficient motivational environment to improve worker performance, job satisfaction, and to attain high construction productivity (Doloi, 2007:30).

3. SKINNER’S REINFORCEMENT THEORY

Reinforcement theory uses rewards and punishments that follow a person’s behaviour as a way to shape that individuals future behaviour (Mosley, Pietri & Mosley, 2008:197). Reinforcement theory merely looks at the association among behaviour and its consequences (Roa, 2009:261). Consequently, positive reinforcement results from applying positive consequence succeeding a wanted behaviour (Nelson & Quick, 2000:180). Supervisors can use four tactics to affect an worker’s behaviour; positive reinforcement, negative reinforcement, punishment and extinction (Schultz, Begrain, Viedge, Potgieter & Werner, 2003:62).

3.1 Positive Reinforcement

To initiate a strategy of positive reinforcement, it should be noted that positive reinforcers and rewards are not inevitably the same (Roa, 2009:157). Recognition, for example, is both a reward and a possible positive reinforcer. Recognition turns out to be a positive reinforcer only if a worker’s performance in future improves (Schemerhorn, Hunt & Osborn, 2008:131).

Positive reinforcement therefore is the use of rewards to increase the possibility that behaviour will be repetitive, like performance bonuses, verbal affirmation or visual signs of approval (Phillips & Gully, 2012:147). A positive reinforcer is instantly applied when performance improves (Betts, 2000:163). A positive reinforcement is any one thing which reinforces the behaviour it follows and makes the behaviour more possible (Phillips & Gully, 2012:147). If a worker is given a bonus for finishing a certain significant task on time and, as a consequence, the worker finishes other significant tasks on time in the future, the reward to be paid to the worker would be said to be a positive reinforcement (Phillips & Gully, 2012:147).

It should be stressed that what may function as a positive reinforcement for one person may not work the same way for another (Schemerhorn et al., 2008:131). One worker may be motivated by a bonus or a raise while another may not. Also, it is imperative to remember that something that functions as a positive reinforcer at one point in time for a
given worker may not at another point in time (Mcafee & Poffenberger, 1982:20).

Supervisors should be particularly cautious when trying to reinforce a crew of workers as oppose to one worker. The crew reinforcer will work only if most or all of the individuals in the group accept the reward given as a positive reinforcement (Schemerhorn et al., 2008:131).

3.2 Using Shaping as a positive reinforcer

Shaping is one method in which positive reinforcement can be used. In this technique, behaviour is steadily improved by selectively reinforcing behaviours that are effectively more similar to the kind of behaviour desired (Pettinger, 2006:267).

A supervisor cannot assume that a worker’s performance will promptly change from totally improper to totally acceptable (Mcafee & Poffenberger, 1982:20). Therefore, the supervisor must reward the worker for advancement made towards targets, not for excellence in performance (Phillips & Gully, 2012:147). Since improvement toward the goal is what is required, each occurrence of progress is rewarded.

3.3 Reinforcement schedules to acquire desired behaviour

The theory of reinforcement schedules denotes to the design in which needed behaviour must be reinforced. Two key reinforcement schedules are often debated: continuous reinforcement and intermittent reinforcement (Mcafee & Poffenberger, 1982:20).

Using continuous reinforcement, persons obtain positive reinforcement each and each time their behaviour improves or changes in the desired way. With intermittent reinforcement, not every desired behaviour, is reinforced (Phillips & Gully, 2012:147). Instead, behaviour is reinforced either unsystematically or according to a fixed ratio, such as reinforcing the worker for every five occasions of desired performance, or reinforcement (salary) every Friday (Mcafee & Poffenberger, 1982:20).

Normally, continuous positive reinforcement would be used when a supervisor is first trying to alter a worker’s behaviour. Intermittent reinforcement, on the other hand, is specified when the supervisor needs to maintain the worker’s behaviour at a required level (Mcafee & Poffenberger, 1982:20).

Positive reinforcement can be given according to either continuous or intermittent strategies. Continuous reinforcement administers a reward each time a desired behaviour occurs. Intermittent reinforcement rewards behaviour only periodically. These alternatives are important because the two schedules may have different impacts on behaviour. In general, continuous reinforcement elicits a desired behaviour more quickly than does intermittent reinforcement (Roa, 2009:215) Thus, continuous reinforcement would be important in the initial training of the apprentice casters. At the same time, continuous reinforcement is more costly in the
assumption of rewards and is more easily extinguished when reinforcement is no longer present. In contrast, behaviour acquired under intermittent reinforcement lasts longer upon the discontinuance of reinforcement than does behaviour acquired under continuous reinforcement. In other words, it is more resistant to extinction. Thus, as the apprentices master an aspect of the pouring, the schedule is switched from continuous to intermittent reinforcement (Phillips & Gully, 2012:147).

Positive reinforcement, when properly directed, can be a very powerful motivator. Unfortunately, one of the lowest-cost tools within positive is also one of the least used-and least appropriately used. That is the simple “thank you” (Robbins & De Cenza, 2001:283).

### 3.4 Punishment

Dissimilar to positive reinforcement and negative reinforcement, punishment is proposed not to encourage positive behaviour but to discourage negative behaviour. Formally defined, punishment is the management of negative consequences or the removal of positive consequences that tend to decrease the possibility of repeating the behaviour in related settings (Schemerhorn et al., 2008:134).

Harassment and reprimands are applied for only reasonable behaviour (Betts, 1998:165). Although harsh punishment may stop behaviour, unavoidably it seems that in the long term side-effects set in (Pettinger, 2006:210). If a supervisor opts to punishment, it should be mixed with some form of reward or praise for a positive response as a result, and it should be applied directly (Betts, 2000:165).

Punishment is normally defined as the presentation of an aversive event or the removal of a positive event succeeding a reply which decreases the frequency of that response (Pettinger, 2006:201). Punishment incorporates two basic actions:

- taking action against an worker (for example, stern glances, verbal warning, written warning, suspension) which has the result of decreasing or removing an undesirable behaviour, or
- suppressing a reward from an worker in an effort to decrease or remove an undesirable behaviour (for example, not receiving a raise because of recurring absenteeism) (Nelson and Quick, 2000:232).

Discipline is certainly the most common method to improving worker productivity used in companies at the present time. Almost all medium- and large- sized companies use penalties within a set of formal disciplinary procedures which they adhere to. Smaller companies also use penalties significantly even though they may not have formal systems. Examples of specific punishments (for example, finger pointing, cross glances, rebukes, and suspensions) used in in companies (Robbins & De Cenza, 2001:225).

However, in both reinforcement theory and expectancy theory motivation is maximised when supervisors make rewards depended on productivity. Rewarding issues other than productivity only acts to reinforce and encourage those other issues. Important rewards such as pay
increases and promotions should be allocated for the achievement of the worker’s specific goals. To maximise the influence of the reward contingencies, supervisors should look for ways to increase the visibility of rewards. Publicising productivity bonuses and allocating annual salary increases in a lump sum rather than distributing them out over the entire year are examples of actions that will make rewards more motivating (Robbins & De Cenza, 2001:283).

4. METHODOLOGY

A qualitative study was undertaken to determine the degree of motivational strategies used by supervisors on construction sites. The motivational strategy explored in this study was reinforcement.

Two construction sites in Bellville, Cape Town were conveniently selected for the purpose of this study. The study was qualitative in nature and semi-structured questionnaires were used to conduct the interviews. Biggam (2009:86) states that qualitative research are linked with exploratory studies. Therefore five respondents from each construction site were interviewed. The trades in which these respondents specialise in are earthworks, concrete, plumbing, bricklaying and electrical work. The data was analysed by using content data analysis.

5. FINDINGS AND DISCUSSIONS

5.1 Demographics of respondents

A total of 10 respondents took part in the study. The respondents were all male. The participants in the study as shown in Table 1 were mainly experienced workers. About 80% were in the construction industry for more than 5 years.

<table>
<thead>
<tr>
<th>Years of experience</th>
<th>No</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-5</td>
<td>2</td>
<td>20</td>
</tr>
<tr>
<td>6-10</td>
<td>5</td>
<td>50</td>
</tr>
<tr>
<td>11-15</td>
<td>3</td>
<td>30</td>
</tr>
<tr>
<td>Total</td>
<td>10</td>
<td>100</td>
</tr>
</tbody>
</table>

Table 1 Working experience

Table 2 shows the status of the workers employers. 80% of the workers are employed by sub-contractors and 20% by the main-contractor.

<table>
<thead>
<tr>
<th>Employer status</th>
<th>No</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main contractor</td>
<td>2</td>
<td>20</td>
</tr>
</tbody>
</table>

Table 2 Employer status
Table 3 shows the skill level of the construction workers. 70% of the workers were unskilled, 20% semi-skilled and 10% skilled.

<table>
<thead>
<tr>
<th>Worker level</th>
<th>No</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unskilled</td>
<td>7</td>
<td>70</td>
</tr>
<tr>
<td>Semi-skilled</td>
<td>2</td>
<td>20</td>
</tr>
<tr>
<td>Skilled</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>Total</td>
<td>10</td>
<td>100</td>
</tr>
</tbody>
</table>

Table 4 shows the trades the respondents were involved in. The trades include bricklaying (20%), concrete (20%), plumbing (20%), electrical (20%) and earthwork workers (20%).

<table>
<thead>
<tr>
<th>Trades of workers</th>
<th>No</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bricklaying</td>
<td>2</td>
<td>20</td>
</tr>
<tr>
<td>Concrete</td>
<td>2</td>
<td>20</td>
</tr>
<tr>
<td>Electrical</td>
<td>2</td>
<td>20</td>
</tr>
<tr>
<td>Plumbing</td>
<td>2</td>
<td>20</td>
</tr>
<tr>
<td>Earthworks</td>
<td>2</td>
<td>20</td>
</tr>
<tr>
<td>Total</td>
<td>10</td>
<td>100</td>
</tr>
</tbody>
</table>

5.2 Reinforcement as a motivational technique

The question required the respondents to indicate whether the reinforcement techniques used on site, in terms of verbal affirmation, visual signs of approval and warnings motivate them towards higher performance. The different reinforcement techniques are listed in Table 5.

5.2.1 Positive reinforcement

<table>
<thead>
<tr>
<th>Frequency of use of positive reinforcement</th>
</tr>
</thead>
<tbody>
<tr>
<td>No.</td>
</tr>
<tr>
<td>-----</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>1.</td>
</tr>
<tr>
<td>2.</td>
</tr>
</tbody>
</table>
5.2.1.1 Verbal affirmation

Only 30% of the respondents state that the supervisor gives verbal affirmation when he does the task to the supervisor’s satisfaction (Table 5). Verbal affirmation will then be expressed in the form as a “well done” from the supervisor. Construction workers feel a sense of accomplishment when the supervisor verbally recognises their efforts. When a supervisor does not verbally recognise efforts construction workers feel a lack of self-worth. Phillips and Gully (2012:147) state that positive reinforcement is important because, when used it increases the possibility that the behaviour will be repetitive. Therefore, the supervisor must reward the worker for advancement made towards targets, not for excellence in performance (Phillips & Gully, 2012:147). Since improvement toward the goal is what is required, each occurrence of progress is rewarded.

5.2.1.2 Visual signs of approval

Only 50% of the respondents state that the supervisor gives visual signs of approval when the task has been done to the supervisors’ approval (Table 5). The most common visual sign used by the supervisor, is the “thumbs up” visual sign. The workers stated that these visual signs are important motivators for them during the day. Workers feel a sense of achievement when supervisors give visual signs of approval. However workers feel a sense of being neglected on site when supervisors do refrain from giving visual signs of approval. Phillips and Gully (2012:147) state that a positive reinforcer is any one thing which reinforces the behaviour it follows and makes the behaviour more possible. A supervisor cannot assume that a worker's performance will promptly change from totally improper to totally acceptable (Mcafee & Poffenberger, 1982:20).

5.3 Punishment

5.3.1 Warnings

Table 6 Frequency of use of punishment

<table>
<thead>
<tr>
<th>No.</th>
<th>Variables</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>N</td>
<td>%</td>
</tr>
<tr>
<td>1.</td>
<td>Warnings</td>
<td>2</td>
<td>20.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>8</td>
<td>80.0</td>
</tr>
</tbody>
</table>

Only 20% of the workers state that supervisors do use warnings on them (Table 6). Workers do feel a sense of harassment when supervisors issue them with warnings. Workers feel less compel to be productive when they are harassed or rebuked. Some of the workers even stated that
supervisors threaten to dismiss them, without the issuing of a prior warning. Pettinger (2006:210) state that although harsh punishment may stop behaviour, unavoidably it seems that in the long term side-effects set in.

5.4 Productivity of construction workers

In regards to productivity, the findings indicate that only 10% of the workers felt the need to enhance their productivity. Workers feel that positive reinforcement techniques aren’t used enough on construction sites in order for them to improve their productivity.

6. Conclusions and recommendations

In regards to reinforcement techniques used on site the workers stated that the supervisors hardly or ever use reinforcement techniques during the day. The findings also revealed that the workers need positive reinforcement to encourage them towards higher productivity. The findings also revealed that the supervisors will rather dismiss workers than issue them with warnings for serious wrong doings.

The research is firstly beneficial to construction workers, because productive workers will enhance their chances of promotion and rewards within the organisation. Also the research is beneficial towards the organisation itself, because a motivated productive workforce will infinitely increase profits.

Therefore most prevalent in the findings of this study is the fact that the workers agreed that a lack of positive reinforcement negatively impact their productivity. As such a further study in supervisory motivational reinforcement strategies to improve worker productivity is recommended to add value to the construction industry. Further studies in reward techniques are also recommended for other construction professionals such as Quantity Surveyors, Architects and Engineers.

7. References


ASOCSA2016-011

The impact of limited contracting opportunities for emerging contractors on implementing CDP mentorship programme

1Sikhumbuzo Lufele, 2Ruben Ndihokubwayo, 3Xolani Nghona
lufeles@cput.ac.za, 2ndihokubwayor@cput.ac.za, 3nghonax@cput.ac.za

1,2,3 Cape Peninsula University of Technology
Department of Construction Management and Quantity Surveying
1MTech student, Tel No. (021) 959 6970
2Lecturer, Tel No. (021) 959 6845
3Lecturer, Tel No. (021) 953 8623

ABSTRACT

Purpose – The purpose of this study is to investigate whether limited contracting opportunities in the Department of Transport and Public Works’ Contractor Development Programme (CDP) impact on the overall implementation of the mentorship programme. Design – A qualitative method was adopted by making use of a case study comprising of semi-structured interviews. Purposive sampling was used to select 2 emerging contractors on the CDP mentorship programme. Data were analysed using content analysis. Research limitations – The study was conducted in the Western Cape targeting emerging contractors with Construction Industry Development Board grade 3 and 5. Findings - The findings have revealed that limited contracting opportunities on CDP have an adverse impact on the overall implementation process of the mentorship programme. The findings further revealed that contractors experience difficulty securing contracts owing to highly competitive tendering, lack of tendering skills and inexperience in terms of pricing for construction projects. Conclusion - Emerging contractors on the CDP programme encounter difficulties to secure contracts from the open tender market since CDP does not offer contracts. Moreover, the lack of contracts on CDP affects contractors’ ability to complete mentorship within the given period of the mentorship programme. Practical implications - The Department of Transport and Public Works should ring-fence some contracts to be used as training projects to enable emerging contractors to implement the skills acquired from classroom training. The current position of CDP in terms of contracts
is to encourage emerging contractors to be innovative and not rely on government for contracts. However, this position has not only created problems for emerging contractors only, but the CDP mentorship programme has been hugely affected. **Value** - Research compels the CDP coordinators and mentors to re-think and re-design their mentorship programme so that it can be effectively implemented. **Keywords:** Emerging contractors, tendering market, tenders, competition, training projects

1. **INTRODUCTION**

In South Africa, Small and Medium Enterprises (SMEs) contribute immensely to the growth of the economy. SMEs play a pivotal role in employment creation, income generation and output growth. This contribution is evident as SMEs account for approximately 60% of all employment and 40% of output (Berry, Blottnitz, Cassim, Kesper, Rajaratnam, & van Seventer, 2002:25; van Heerden, Mashatole and Burger, 2014:57). The effect of this contribution is significant in terms of addressing socio-economic challenges such as unemployment and lack of skills. SMEs in South African context according to the National Small Business Act No. 26 of 2003 define emerging contractors as businesses who qualify as a small business. Moreover, such businesses came into existence as the result of past dispensation during which small businesses were excluded from participating on the mainstream of the economy. In the South African construction industry for instance, there is a continuous establishment of black-owned Small and Medium Contractors (SMCs) by previously Historically Disadvantaged Individuals (HDIs) (Martin & Root, 2010:64). The HDIs consist of the non-white population who were excluded from participating in any formal national economic activity during the apartheid era. Emerging contractors have not had a smooth ride in running their businesses without encountering problems along the way. As a result of these problems some emerging contractor businesses have either decided to wind up their businesses or weathered the storm. These problems have been identified by Malongane (2014:9), Thwala (2014:772) and Lazarus (2005:33). The research findings, indicate that problems faced by emerging contractors not only remain unresolved but continuously contribute to the failure of emerging contractors. Malongane (2014:9) complains about these problems as they affect the organisation both internally and externally. According to Thwala and Phaladi (2009:200); Iruka and Shakantu (2015:328) the sustainability of many emerging contractors is questionable in South Africa. This issue still appears to have an impact on the South African construction sector despite having been raised more than seven years ago (Construction Industry development Board & Construction Education and Training Authority, 2005). The purpose of the CDP mentorship programme is to develop small and medium contractors already in the industry and enhance their skills in the
contracting business. The mentorship programme targets contractors with CIDB grade 1 and 5 over an 18 month period. According to CIDB (2011:7) various government departments across the South Africa experience problems with regards to implementation of CDP. The Western Cape’s CDP is not immune from these challenges, the Western Cape CDP is confronted with its own challenges with regards to lack of technical, managerial and contractual skills amongst emerging contractors. These challenges amongst emerging contractors have resulted in a few contractors winning contracts and high rate of failure in the project performance (CIDB, 2011:58). This state of affairs has reduced the participation of Historically Disadvantaged Individuals (HDIs) in infrastructure opportunities in the province, and reduced the transformation of the sector (CIDB, 2011:58). The objective of this study is to investigate the extent to which limited contracting opportunities impact on the overall implementation process of CDP mentorship programme.

2. TENDERING PROBLEMS FACED BY EMERGING CONTRACTORS

2.1 The problematic tendering process

Nokes and Kelly (2007:295) define tendering as the action of confirming a price offer for specified tasks or activities of a project in a prescribed method to the client. The client appreciates it as a procurement process to acquire products and services from outside the project team. Woods (2008:235) defines tendering as a process where an organisation invites contractors for the supply of goods and services, and awards the contract to the best offer according to predetermined criteria. Woods (2008:235) further argues that tendering is an essential anticorruption approach. Moeti et al (2007:124) state that a tender is a proposal to provide goods or services in competition with other potential suppliers. It is crystal clear from the definitions above that tendering is simply about providing goods or services to an organisation or a client. Contractors would respond to the proposal by making an offer to an organisation to provide goods or services. The possibility for the contractor to secure the contract is determined by the competitiveness and soundness of the offer submitted to an organisation. It is therefore incumbent upon contractors to adhere to all tender requirements and failure to do so may lead to contractors not securing a tender or proposal. Martin and Root (2009:66) discuss problems faced by contractors and highlight general lack of knowledge; deficiencies in the knowledge of pricing procedures, contractual rights and obligations, management techniques and principles, technology, as well as general law.

Table 1.1 provides an overview of the total number of registered contractors on the CIDB register of contractors in the Western Cape Province. CDP recruits contractors directly from the CIDB database, those
contractors the CDP selects from CIDB grade 3 and 5 categories then partake on the CDP mentorship programme. Most of these contractors are either registered for CE or GB categories as shown below in columns 3 and 4. The challenge though for grade 4 contractors is that there are more contractors registered for this grade compared to grade 3 and grade 5, and that means more competition. Contractors with CIDB grade 5 seem to have less competition as compared to 79 for grade 3 and 135 for grade 4.

Table 1.1: Class of Works by Grading - Western Cape

<table>
<thead>
<tr>
<th>Designation</th>
<th>CE</th>
<th>GB</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>985</td>
<td>3319</td>
<td>4304</td>
</tr>
<tr>
<td>2</td>
<td>89</td>
<td>153</td>
<td>242</td>
</tr>
<tr>
<td>3</td>
<td>33</td>
<td>46</td>
<td>79</td>
</tr>
<tr>
<td>4</td>
<td>48</td>
<td>87</td>
<td>135</td>
</tr>
<tr>
<td>5</td>
<td>21</td>
<td>33</td>
<td>54</td>
</tr>
<tr>
<td>6</td>
<td>53</td>
<td>54</td>
<td>107</td>
</tr>
<tr>
<td>7</td>
<td>31</td>
<td>33</td>
<td>64</td>
</tr>
<tr>
<td>8</td>
<td>12</td>
<td>11</td>
<td>23</td>
</tr>
<tr>
<td>9</td>
<td>8</td>
<td>8</td>
<td>16</td>
</tr>
<tr>
<td>Total</td>
<td>1280</td>
<td>3744</td>
<td>5024</td>
</tr>
</tbody>
</table>

Source: CIDB (2016)
CE - Civil Engineering
GB - General Building

2.2 Competitive nature of the tender market

The South African government adopted the tendering system where the government utilise proposals and offers for delivering goods and services from contractors to the clients. The tendering system provides basis for an intense competition among contractors who are tendering for the project. However, the increased competition does not deter contractors entering the tender market. According to Thwala and Phaladi (2009:535) there are a large number of small contractors at the lower end of the market that competes against each other and that has a ripple effect on small contractors in terms of maintaining a sustainable workflow. Iruka and Shakantu (2015:328) argue that it is incumbent upon emerging contractors to weather the storm and remain competitive and economically sustainable by developing a dynamic business strategy that would embrace the changing trends and conditions in today’s business world. Further Thwala and Phaladi (2006:87) reveal that emerging contractors are confronted with increasing competition as a result of a decline in demand for construction.
In response to the market conditions, contractors decide to lay off their workers.

2.3 Training projects

According to CIDB (2011:8) guidelines for contractor development with regards to approaches in improving contractor development programmes is to improving access to work opportunities by packaging projects into smaller sizes which the contractors can undertake. Moreover, to improving tendering procedures and simplifying tender documentation. Haupflesch (2006:3) highlights the use of labour intensive method delivery projects in government-funded service delivery projects to create more work opportunities and stimulate entrepreneurial activity. Van Heerden, Mashatole and Burger (2014:60) agree that government initiatives have been rolled out to create opportunities for small contractors to engage in training programmes in-line with their core business to foster growth and development. The Department of Public Works (2016:8) explains that in a mentorship programme it allocates as training projects based on negotiated prices and standard rates. The purpose of the training projects is as follows:

- to ensure that the participants have continuity of work while they are in the programme, so that the current weakness of the Emerging Contractor Development Programme can be addressed;
- to enable participants to receive training and mentoring on the tendering process itself, so that they can become progressively more capable of tendering accurately on their own; and
- to provide the practical component to the theory that learners are taught in class.

3. METHODOLOGY

The purpose of this study is to investigate whether limited contracting opportunities on the CDP impact on the overall implementation of the mentorship programme by using 2 emerging contractors as a case study. The main reason for pursuing this particular study is because of the number of problems experienced by emerging contractors as a result of the lack of contracting opportunities on the CDP mentorship.

Purposive sampling was used to select 2 emerging contractors based in the Western Cape. Purposive sampling is a useful sampling method which involves the receiving of information from a sample of the population (Leedy & Ormond, 2010:147). Furthermore, the researcher needs to be choosy and not conduct the research on everyone but select a sample size that is sufficient enough to yield enough reliable data for inferences to be drawn (Fellows & Liu, 2008:152). Semi-structured interviews were conducted on emerging contractors with CIDB grade between 3 and 5.
Questions were structured into three sections. Section A covered personal information relating to the contractor, Section B focused on contractors’ personal limitations and Section C focused on mentorship programmer’s limitations. Respondents were first informed of the focus and the purpose of the interview prior to the meeting. This assisted the respondents to prepare adequately for the interview in advance. Each interview took 20 minutes and was voice recorded and subsequently transcribed.

4. FINDINGS

4.1 Description of interviewees

Two contractors from Western Cape were selected and interviewed regarding their participation on the CDP mentorship. Interviewee A is the owner of a construction company that specialises on construction and development in Atlantis. Interviewee A has 17 years’ experience including 2 years spent on the mentorship programme. Interviewee B is also the owner of a construction company involved in general building in Cape Town and surroundings. Further, interviewee B had 8 years construction experience before joining the mentorship programme and now has 10 years including 2 years spent on the mentorship programme.

Table 1.2 Interviewee personal profiles

<table>
<thead>
<tr>
<th>Interviewee</th>
<th>Position in the company</th>
<th>Gender</th>
<th>Construction experience (years)</th>
<th>Duration into mentorship programme (years)</th>
<th>CIDB Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Site Manager</td>
<td>Male</td>
<td>17</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>B</td>
<td>Site Manager</td>
<td>Male</td>
<td>10</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

The table above shows industry experience in terms of the respondents to this study. According to the table above interviewee A has CIDB grade 5
and has a number of years in the construction industry. Interviewee B has CIDB grade 3 and less experience compared to Interviewee B.

4.2 Contractor’s personal limitations

4.2.1 Tendering skills

Interviewees were asked about their capability with regards to pricing tender documents and complying with tender requirements.

According to Interviewee A, tendering requires a contractor to have acquired tendering skills in terms of pricing a competitive bid. It begins by following a good selection process. Interviewee A is now able to select a tender based on area, tender type, type of work and the size of the project. Throughout the process the contractor has learned a lot in terms of tendering and now is able to use tendering skills whenever tendering for projects.

However, Interviewee B found tendering to be a stumbling block, difficult to comprehend, price as well as to adhere to all tender requirements. Interviewee B argued that it is extremely difficult to price tender documents especially if it’s not the contractors’ line of expertise. The interviewee further said that large construction firms have an advantage because they have specialised departments within their businesses where tender documents are priced and not the owner. The owner’s job is to market the business and find new business. The interviewee further stated that smaller contractors find it very difficult to do everything on their own. Instead the contractor relies on external consultants for completing tender documents on behalf of the contractor which has an extra cost attached to it.

4.2.2 The ability to participate in competitive market

Interviewees were asked about their chances in securing a tender given the competitive nature of the tender market.

According to Interviewee A, competition in the industry is intense such that one would need to improve their pricing and tendering skills because the competition is becoming more intense given the huge numbers of quotes or tenders that are submitted at the municipal or provincial tender offices. Interviewee B agrees with Interviewee A in terms of intense competition for tenders and said that if one carefully studied the open tendering market one would notice that it is extremely difficult for a small contractor to secure tenders because tendering is about competing with many other contractors and there’s no guarantee in getting a tender.
4.3 Mentorship programme’s limitations

Interviewees were asked about the lack of contracting opportunities and how they have affected their progression within the mentorship programme.

Interviewee A explained that there were no training projects created on the CDP mentorship programme for emerging contractors to implement what has been learned from classroom training. There were very little opportunities presented from the beginning of the programme. The interviewee had to find a contract to be used as a training project and never received any contracts from the CDP. The interviewee elaborated that the manner in which mentorship is implemented did not make sense because contractors were trained without projects and after a while when contractors managed to secure projects on their own, then training had already completed. The interviewee felt that as contractors they should be mentored in terms of skills acquired on the programme by creating a project opportunity for contractors so that skills can be applied because the success of a project depends on skills acquired.

Interviewee B also was never provided with any contracting opportunities. Instead the contractor took own initiative and used current projects as a training project for mentorship. The interviewee felt the Department of Transport and Public Works of the Western Cape should have identified certain projects for small contractors where they would receive training on tendering prior to competing for tenders with already established contractors on the open tender market. The interviewee could not establish logic to train contractors to tender when there were no tenders for implementation. Furthermore, the interviewee felt the Department of Public Works and Transport should have identified certain projects for small contractors where they would be trained to tender than competing with other contractors on the tender market. It did not make sense to the interviewee for CDP to train contractors to tender when there were no tenders for implementation. Moreover, the contractor mentioned the current approach did not yield the expected results and no contractor could claim to know how to tender or to price a tender document.

5. CONCLUSIONS

It is evident from the findings that even though training on tendering have been done. Contractors are still unable to put together a competitive bid that would assist to secure a contract on the open tender market. As a substitute to the lack of skills, contractors tend to rely on consultants for
pricing of tenders which is an added cost to the already financially struggling contractor. The challenge that comes with consultants pricing tender documents for contractors is it leaves contractors clueless in terms of the projects’ profit. Competition in the construction industry is very intense especially for contractors graded lower on the CIDB register of contractors. Moreover, the competition is intense not only for emerging contractors on the CDP mentorship programme but for other contractors outside the mentorship programme. This situation for CDP emerging contractors is problematic and further worsened by their lack of tendering skills which subsequently leads to their failure to secure contracts.

With regards to the issue of training projects, contractors do not support the status quo as the lack of contracts on the mentorship programme continues to impact on their participation on the mentorship programme. However, CDP encourages contractors to be innovative to find contracts on their own without assistance from government. The mentorship implementation process is impacted upon due to the lack of contracts on the mentorship programme. Consequently, contractors who are able to use their own contracts do receive mentorship and contractors without contracts still need to complete the programme.

6. RECOMMENDATIONS

The findings do confirm that a problem exists in the CDP mentorship programme with regards to the need for training projects. On the point of view of contractors, they are frustrated by the fact that there are no contracts on the programme. The Western Cape Department of Transport and Public Works should review their policies and set aside projects for small contractors participating on the mentorship programme.

Further research should be done on contractors’ personal limitations especially evaluating the extent to which the contractors' tendering and estimating competency levels hinder them from securing contracts. With regards to the training projects on the mentorship programme further research is needed to establish whether lack of funds is a constraint faced by the Department of Transport and Public Works to set aside such projects. This qualitative study serves as an exploratory study to find out problems faced by emerging contractors during the implementation process of CDP mentorship, a comprehensive quantitative study is necessary to explore limitations within the CDP programme and participating contractors.
7. REFERENCES


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Financial management capacity and business failure of contractors

Theo C. Haupt and Karanagran Padayachee

Haupt@ukzn.ac.za and karana@kpacons.co.za

1 Professor, Construction Studies Program, University of KwaZulu-Natal, Howard College, Durban 4001, South Africa. (Tel: +27 31 2602712)
2 Faculty of Engineering, Department of Construction Management & Quantity Surveying, Mangosuthu University of Technology, Umlazi, Durban 4026, South Africa. (Tel: +27 31 9077557)

ABSTRACT AND KEYWORDS

Purpose: The study sought to explore the challenges and barriers facing contractors registered with the Construction Industry Development Board (CIDB) in Grades 2-4 with emphasis on the impact of their lack of financial skills on the sustainability of their businesses.

Design/methodology/approach: A sample of 30 contractors registered with the Construction Industry Development Board (CIDB) in Grades 2-4 in Durban was surveyed using an instrument developed from published literature on the importance of financial management skills on business sustainability.

Research limitations: The sample of contractors was drawn from the Durban area using the Construction Industry Development Board (CIDB) Register of Contractors in Grades 2-4 and the findings may therefore not necessarily be generalizable across the entire sector.

Findings: Preliminary findings suggest that contractors experience difficulty in accessing finance as a result of their lack of financial management skills.

Response to conference theme: This study identifies the reasons why contractors in the lower CIDB grades struggle to access finance from financial institutions which affect their sustainability.

Practical implications: The findings inform the need for financial management skills training of contractors in CIDB Grades 2-4 to ensure their access to finance

Keywords: Finance, financial management, construction, contractors

Conference sub-theme: Construction Education
1. INTRODUCTION

In a typical modern society, around half of all physical assets are created by the construction industry generating about 5 – 10% of national wealth (Ahadzie, 2010). A major part of these contractors in the South African public sector of the construction industry are SME’s in Construction Industry Development Board (CIDB) Grades 2 - 4. SME’s have been noted to be the engine through which the growth objectives of developing countries can be achieved and are potential sources of income. (Kayanula and Quartey 2000). The continuous failure of these SME’s is an ongoing concern in the construction sector. Therefore this study sought to explore the challenges and barriers facing contractors registered with the Construction Industry Development Board (CIDB) in Grades 2-4 with emphasis on the impact of their lack of financial skills on the sustainability of their businesses.

2. CONSTRUCTION BUSINESS SUCCESS FACTORS AND INFLUENCES

Successful construction businesses are influenced by many factors. Operational variables according to Rush, Bessent and Hobday (2007) are key abilities of firms in using their technological competence to gain strategic competitive advantage. Bell (2003) on the other hand noted that the ability of firms to develop from having a small capability to a level of acquiring competence determines their performance. Among many factors that determine the success of a business venture and in this case a construction enterprise are those related directly and indirectly to the management of the finances of the business. If poorly handled the enterprise is likely to struggle to grow and survive in a highly competitive market. Bakar (1993) established that financial availability and adequate cash flow of firms enhances profitability which in turn enhances performance. According to Robertson (2010) smooth cash flow ensures the effective delivery of projects and is essential to develop and sustain a healthy, professional and competitive construction industry. Therefore prompt payment by clients to the contractor and regular payments of subcontractors is an important success factor. Proper bookkeeping is an essential tool required for the success of a construction business. If haphazard accounting can contribute to financial ruin, it is possible that good accounting practices can contribute to a small construction company’s success. Successful companies need an effective internal accounting system. They may also need the help of outside advisors, such as a certified public accountant who specializes in construction accounting (Davidson, 2006). Cost of finance and sound money management also plays an important role as this affects the contractors working capital.
3. CAUSES OF BUSINESS FAILURE

The construction industry has the second highest failure rate of all industries, second only to business services (Paz, 2006). Contractor failure occurs when a contractor is unable to perform his/her contractual duties, therefore requiring the facility owner to invoke the contract's non-performance (Russell, 1991). According to the National Stakeholders Forum Report contractors are awarded building contracts without having the requisite capacity or expertise (CIDB, 2012). It is also widely believed that the acquisition of construction projects by the small and medium contractors in South Africa is just a means of project availability and security guarantee to contractors rather than building and improving their capacity (Twala and Mvubu, 2008). Furthermore, the South African Construction industry has been found to suffer from unfair tendering practices (Bowen, Akintoye, Pearl and Edwards, 2007). This situation arises from the award of contracts being generally based on socio-political reasons and not on the capacities and capabilities of contractors (Mbachu, 2008). According to Statistics South Africa, construction companies suffer degradation, failure and finally drop out of business due to lack of capacities and capabilities (2005). Additionally Calvert et al. (2003), also assert that far more companies go out of business or are not performing because they are not solvent rather than fail because they are not profitable. Navon (1996) explained that construction companies often fail due to liquidity constraints, and construction companies could temporarily survive slow profits or even a loss, but can fail because of cash flow constraints despite showing profits on paper.

Strategic management is viewed as the set of decisions and actions that result in the formulation, implementation and control of plans designed to achieve an organisation’s vision, mission, strategy and strategic objectives within the business environment in which it operates (Pearce & Robinson 2007). The most important problems in the field of strategic management are not related to strategy formulation, but rather to strategy implementation (Flood et al. 2000), and that the high failure rate of organisational initiatives in a dynamic business environment is primarily due to poor implementation of new strategies. Due Diligence, or Reasonable Diligence is giving attention to the matter at hand. It is the diligence which is required by the circumstances, and the rendering of that which prevents liability for negligence. The term "due diligence" equates to another term "Quality Control": (Poles, 1995). Lack of quality control leads to defects and could be a cause for business failures. The construction industry has been identified as the most corrupt sector in the world (de Jong et al. 2009). The main forms of corruption as identified by Grobler and Joubert (2004) and Hartley (2009) is patronage, nepotism, bribery, ghosting, kickbacks, front companies, embezzlement, bid rigging and collusion, and conflict of interest. Access to finance as per Bondinuba (2012) includes issues such as the availability of financial services in the
form of deposits, finance, payments, or insurance to individuals or firms. The availability of such services can be constrained for instance by physical access, affordability or eligibility.

4. EFFECTS OF CONTRACTOR FAILURE

Business failure can inflict substantial negative impact on numerous stakeholders (Deakin, 1972) and so is of concern to owners, policy makers, industrialists, investors, managers and governments (O’Leary, 1998). Phillips (2011) summed-up these impacts as “lives ruined, jobs lost, communities destroyed, time and money wasted [...]” which perhaps explains, why for many firms failure is a topic they care not to acknowledge (Kangari, 1988). The indirect costs of failed companies far exceed the direct costs of their failure (Mason & Harris, 1979; Wong & NG, 2010; Singh & Lakanathan, 1992). Contractor failure negatively impacts on a project by having severe disruptions to a project which in turn delays the project thereby increasing the project costs. A contractor’s failure can delay a project, increase costs and may deprive the client of remedies and third parties of meaningful warranty protection (Freshfields, 2009). It may also mean the client is left without an enforceable remedy for future defects (Ibid). A lack of cash can mean no payments to subcontractors, labourers, and crews, and no purchases of needed materials. It can lead to limited ability to complete tasks on site, cutting corners in work, or slower pace to match the amount of cash available. Negative outcomes can include delayed or incomplete work or increased financing costs and project risks. There is also a social impact from business failure (Sridharan et al., 2002) which is perhaps why the larger the failed business, the easier it will make the news headlines (Dasgupta and Sanyal, 2010).

5. KNOWLEDGE OF KEY BUSINESS CONCEPTS

Project management, target market and tendering are key business concepts that are important to sustain a business. Inconsistent project management practices influence companies’ competitive position in the market place (Bolles, 2002). Cattell (1993) posits that the ability of an individual to market themselves as well as their firm is one of the common factors of business success. Budgeting and forecasting are also important knowledge factors to be taken into consideration. Surveys of construction practitioners point to financial and budgetary factors as the leading causes of failures (Arditi, Koksal, & Kale, 2000; Kangari, 1988; Davidson & Maguire, 2003; (Kivrak & Arslan, 2008). Financial risks and mitigation thereof, although not a priority to most firms need to be identified. Those firms that have implemented a financial risk management process have recognised that there would be a higher probability of failure if appropriate
techniques are not carefully employed during the financial risk identification stage (Rostami 2014).

6. USE OF TYPES OF FINANCE

Naoum (2003) and Beatham et al. (2004) acknowledge that financial availability and adequate cash flow of firms enhances performance as well as profitability which is a basic goal for running a business. Payment as work is completed and deposits from clients are the most common type of finance used in construction businesses. Financial assistance from financial institutions also plays an important role namely both the banking and non-banking sectors. Financial institutions have a limited interest in funding the SME’s especially those seeking funds as start-up capital for their firms because of the risk associated with new firms, where it is known that eight out of ten new firms fail within the first three years (Mason, 2011). According to Bondinuba (2012) the role of the non-banking sector to the SME’s is serving as effective financial intermediaries. Finance from micro-lenders although not popular is said to be a development tool intended to bring economic benefits to the productive poor or the low income clients who for various reasons cannot access financial services from the normal or the traditional banks (Ibid). In the absence of access to any formal types of finance, SMEs generally have to rely on their own personal savings and investments to fund themselves particularly in the early stages of their businesses. The most popular source of startup financing is the personal savings of the business's founder. (Advani, 2006).

7. IMPORTANCE OF SOURCES OF FINANCE

Available forms of finance for SME’s come in many different forms. Over the years, SMEs have been supported through a number of means, from government assistance, financial institutions assistance, donor agencies, plough back profit, to family support and franchising arrangement, among others (Abor and Biekpe, 2006). Some contractors also used their personal savings as a form of finance for their business operations. Most SME’s appear to be challenged in financing their business operations (Ibid). This is due to many factors which include lack of the ability to meet collateral requirements, informational barriers, regulations and rules, and the lack of fiscal incentives for SME’s (Bondinuba 2012). Kayanula and Quartey (2000) argued that factors like availability and cost of finance are the most common constraints faced. If SMEs are unable to source financial assistance their businesses are doomed to fail.
8. RESEARCH APPROACH

A convenience sample was surveyed comprising of 30 Small Medium Enterprise (SMEs) contractors in the KwaZulu-Natal province of South Africa about their views on factors and influences that affect the success of construction businesses, business failure, impacts of business failure, knowledge of key business concepts, forms and types of business finance and sources of financial funding. The data was collected via a quantitative questionnaire survey comprising of several sections, namely a section containing 20 factors and influences that affect the success of businesses, a section containing 21 factors and influences contributing to business failure, a section containing 3 consequences of contractor failure, a section containing 17 key business concepts, a section containing 6 forms and types of business finance and a final section containing 7 sources of finance to which respondents were required to give a scaled response of agreement. Descriptive statistics were derived using SPSS v23 and presented including measures of central tendency and dispersion. The internal validity of scaled responses was determined by the Cronbach’s alpha co-efficient for validity.

9. RESEARCH FINDING

Profile of respondents

Most respondents had worked in the construction industry for between 1 and 10 years (66.7%). More than half of the respondents (56.7%) have CIDB gradings for between 1 and 10 years as follows:

- Grade 1 – 41.2%,
- Grade 2 – 17.6%,
- Grade 3 - 17.6%,
- Grade 5 – 11.8%; and
- Grade 7 – 11.8%.

Reliability

The Cronbach’s alpha co-efficient for the various scaled responses indicate acceptable degrees of internal consistency for all scales used, namely a Cronbach Alpha statistic which is greater than the rule-of-thumb 0.70 for acceptable internal scale consistency. There is therefore between 78.0% and 96.8% probability that the constructs each measure a single underlying concept with an error of at most 5%. The scale used is therefore acceptable in measuring of the reliability of the constructs.
Table 1. Reliability co-efficient (n=31)

<table>
<thead>
<tr>
<th>Construct</th>
<th>Reliability co-efficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Business success factors</td>
<td>0.968</td>
</tr>
<tr>
<td>Business failure factors</td>
<td>0.927</td>
</tr>
<tr>
<td>Consequences of contractor failure</td>
<td>0.876</td>
</tr>
<tr>
<td>Key business concepts</td>
<td>0.950</td>
</tr>
<tr>
<td>Forms and types of business finance</td>
<td>0.817</td>
</tr>
<tr>
<td>Sources of finance</td>
<td>0.780</td>
</tr>
</tbody>
</table>

Construction business success factors

Respondents were presented with a list of 20 factors and influences and required to indicate using a 5-point Likert scale the impact that each would have on the success of construction businesses. Their responses ranked by the means are shown in Table 2.

Table 2. Construction business success factors and influences (n=31)

<table>
<thead>
<tr>
<th>Factor/Influence</th>
<th>Mean</th>
<th>Std Dev</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prompt payments by clients</td>
<td>4.60</td>
<td>0.77</td>
<td>1</td>
</tr>
<tr>
<td>Regular payment of sub-contractors</td>
<td>4.39</td>
<td>1.09</td>
<td>2</td>
</tr>
<tr>
<td>Proper bookkeeping</td>
<td>4.31</td>
<td>1.17</td>
<td>3</td>
</tr>
<tr>
<td>Cost of finance</td>
<td>4.30</td>
<td>1.18</td>
<td>4</td>
</tr>
<tr>
<td>Sound money/financial management</td>
<td>4.23</td>
<td>1.22</td>
<td>5</td>
</tr>
<tr>
<td>Regular payment of suppliers</td>
<td>4.21</td>
<td>1.24</td>
<td>6</td>
</tr>
<tr>
<td>Management skills and training</td>
<td>4.20</td>
<td>1.06</td>
<td>7</td>
</tr>
<tr>
<td>Adequate cashflow during construction</td>
<td>4.19</td>
<td>1.25</td>
<td>8</td>
</tr>
<tr>
<td>Favourable credit from suppliers</td>
<td>4.17</td>
<td>1.21</td>
<td>9</td>
</tr>
<tr>
<td>Access to appropriate technology</td>
<td>4.13</td>
<td>1.02</td>
<td>10</td>
</tr>
<tr>
<td>Access to guarantees and performance bonds</td>
<td>4.13</td>
<td>1.25</td>
<td>11</td>
</tr>
<tr>
<td>Institutional capacity</td>
<td>4.10</td>
<td>1.08</td>
<td>12</td>
</tr>
<tr>
<td>Access to finance during pre-construction phase</td>
<td>4.10</td>
<td>1.18</td>
<td>13</td>
</tr>
<tr>
<td>Basic business skills</td>
<td>4.06</td>
<td>1.24</td>
<td>14</td>
</tr>
<tr>
<td>Access to a range of financial products and services</td>
<td>4.06</td>
<td>1.24</td>
<td>14</td>
</tr>
<tr>
<td>Availability of bridging finance</td>
<td>4.03</td>
<td>1.25</td>
<td>16</td>
</tr>
<tr>
<td>Debt-based financing by micro-lenders and microfinance banks</td>
<td>3.94</td>
<td>1.21</td>
<td>17</td>
</tr>
<tr>
<td>Favourable and stable interest rates</td>
<td>3.90</td>
<td>1.16</td>
<td>18</td>
</tr>
<tr>
<td>Enabling environment for SMME’s</td>
<td>3.86</td>
<td>1.22</td>
<td>19</td>
</tr>
<tr>
<td>Fiscal incentives</td>
<td>3.40</td>
<td>1.43</td>
<td>20</td>
</tr>
</tbody>
</table>

From Table 2 it is evident that 16 of the 20 financial factors and influences were reported by respondents to potentially have a significant to major
impact on the success of a construction business with prompt payment by clients having the most impact (mean=4.60). The next influential factors were reported as regular payments of sub-contractors (mean=4.39), proper bookkeeping (mean=4.31) and cost of finance (mean=4.30). The least influential factor was fiscal incentives (mean=3.40). Notably those factors that typically form part of government-driven programs were the least influential.

### Causes of business failure

Respondents were presented with a list of 21 factors and influences and required to indicate using a 5-point Likert scale the impact that each would have on the failure of construction businesses. Their responses ranked by the means are shown in Table 3.

<table>
<thead>
<tr>
<th>Factor/Influence</th>
<th>Mean</th>
<th>Std Dev</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poor strategic leadership</td>
<td>4.55</td>
<td>0.77</td>
<td>1</td>
</tr>
<tr>
<td>Lack of due diligence</td>
<td>4.45</td>
<td>0.89</td>
<td>2</td>
</tr>
<tr>
<td>Corruption</td>
<td>4.39</td>
<td>1.23</td>
<td>3</td>
</tr>
<tr>
<td>Lack of finance</td>
<td>4.30</td>
<td>1.15</td>
<td>4</td>
</tr>
<tr>
<td>Inflexible labour laws</td>
<td>4.20</td>
<td>1.19</td>
<td>5</td>
</tr>
<tr>
<td>High cost of capital</td>
<td>4.16</td>
<td>1.27</td>
<td>6</td>
</tr>
<tr>
<td>Tax regulations</td>
<td>4.13</td>
<td>0.97</td>
<td>7</td>
</tr>
<tr>
<td>Prohibitive tax rates</td>
<td>4.13</td>
<td>1.11</td>
<td>8</td>
</tr>
<tr>
<td>Extremely keen competition for limited opportunities</td>
<td>4.13</td>
<td>1.18</td>
<td>9</td>
</tr>
<tr>
<td>Inconsistent government policies</td>
<td>4.13</td>
<td>1.36</td>
<td>10</td>
</tr>
<tr>
<td>Limited range of financial products and services</td>
<td>4.03</td>
<td>1.33</td>
<td>11</td>
</tr>
<tr>
<td>Inadequate financial infrastructure</td>
<td>4.00</td>
<td>1.17</td>
<td>12</td>
</tr>
<tr>
<td>Inadequate capitalization</td>
<td>3.90</td>
<td>1.10</td>
<td>13</td>
</tr>
<tr>
<td>Lack of success</td>
<td>3.90</td>
<td>1.25</td>
<td>14</td>
</tr>
<tr>
<td>Various mandatory company/business/trade regulations</td>
<td>3.87</td>
<td>1.14</td>
<td>15</td>
</tr>
<tr>
<td>Series of unlikely events</td>
<td>3.84</td>
<td>1.29</td>
<td>16</td>
</tr>
<tr>
<td>Lack of information</td>
<td>3.81</td>
<td>1.38</td>
<td>17</td>
</tr>
<tr>
<td>Insufficient collateral</td>
<td>3.80</td>
<td>1.54</td>
<td>18</td>
</tr>
<tr>
<td>Failure to innovate</td>
<td>3.68</td>
<td>1.14</td>
<td>19</td>
</tr>
<tr>
<td>Regulatory rigidities such as FICA</td>
<td>3.63</td>
<td>1.40</td>
<td>20</td>
</tr>
<tr>
<td>Economic crisis</td>
<td>3.61</td>
<td>1.20</td>
<td>21</td>
</tr>
</tbody>
</table>

It is evident from Table 3 that poor strategic leadership within the business (mean=4.55), lack of due diligence (mean=4.45), corruption and lack of finance (mean=4.30) would have the most impact on business failure. However, 12 of
the 21 factors/influences were reported as having significant to major impacts (means ranging between 4.00 and 4.55). Failure to innovate (mean=3.68), regulatory rigidities such as FICA (mean=3.63) and economic crisis (mean=3.61) would have the least negative impact on a construction business.

Effects of contractor failure

From Table 4, respondents agreed strongly that contractor failure would cause delays in the construction program, increased project costs and severe disruptions to a project.

Table 4. Effects of contractor failure

<table>
<thead>
<tr>
<th>Factor/Influence</th>
<th>Mean</th>
<th>Std Dev</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Delays in the program</td>
<td>4.26</td>
<td>1.09</td>
<td>1</td>
</tr>
<tr>
<td>Increased project costs</td>
<td>4.26</td>
<td>1.15</td>
<td>2</td>
</tr>
<tr>
<td>Severe disruptions to a project</td>
<td>4.23</td>
<td>1.31</td>
<td>3</td>
</tr>
</tbody>
</table>

Knowledge of key business concepts

Table 5. Knowledge of key business concepts

<table>
<thead>
<tr>
<th>Topic</th>
<th>Mean</th>
<th>Std Dev</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project management</td>
<td>4.13</td>
<td>1.12</td>
<td>1</td>
</tr>
<tr>
<td>Target market</td>
<td>4.12</td>
<td>1.14</td>
<td>2</td>
</tr>
<tr>
<td>Tendering</td>
<td>4.10</td>
<td>1.14</td>
<td>3</td>
</tr>
<tr>
<td>Pricing</td>
<td>3.97</td>
<td>1.30</td>
<td>4</td>
</tr>
<tr>
<td>Business plan</td>
<td>3.94</td>
<td>1.12</td>
<td>5</td>
</tr>
<tr>
<td>Budgeting and forecasting</td>
<td>3.90</td>
<td>1.21</td>
<td>6</td>
</tr>
<tr>
<td>Costs and cost control</td>
<td>3.87</td>
<td>1.28</td>
<td>7</td>
</tr>
<tr>
<td>Sales and selling</td>
<td>3.83</td>
<td>1.42</td>
<td>8</td>
</tr>
<tr>
<td>Venture capital</td>
<td>3.80</td>
<td>1.40</td>
<td>9</td>
</tr>
<tr>
<td>Risk management</td>
<td>3.68</td>
<td>1.30</td>
<td>10</td>
</tr>
<tr>
<td>Competitive analysis</td>
<td>3.60</td>
<td>1.10</td>
<td>11</td>
</tr>
<tr>
<td>Finance and accounting</td>
<td>3.45</td>
<td>1.39</td>
<td>12</td>
</tr>
<tr>
<td>Break-even point or analysis</td>
<td>3.42</td>
<td>1.36</td>
<td>13</td>
</tr>
<tr>
<td>Balance sheet</td>
<td>3.29</td>
<td>1.35</td>
<td>14</td>
</tr>
<tr>
<td>Equity</td>
<td>3.16</td>
<td>1.24</td>
<td>15</td>
</tr>
<tr>
<td>Income statement</td>
<td>3.03</td>
<td>1.45</td>
<td>16</td>
</tr>
<tr>
<td>Legal structures for ventures (forms of business entities)</td>
<td>2.77</td>
<td>1.38</td>
<td>17</td>
</tr>
</tbody>
</table>

Respondents were asked to indicate on a 5-point Likert scale the extent of their knowledge of 17 key business concepts. Their responses ranked by the means are shown in Table 5. It is evident that they had average to some knowledge of 16 of the key concepts with means ranging from 3.03 to 4.13. They had the least
knowledge of the legal structures for ventures or forms of business entities (mean=2.77) suggesting that the forms of business that they may have opted for might be inappropriate for the construction activities they engaged in. They had some knowledge of project management (mean=4.13), their target market (mean=4.12), and tendering (mean=4.10). Clearly if they wanted to do better in business their knowledge levels of these key business concepts needed to be much greater than reported.

### Use of types of finance

From Table 6 it is evident that the most dominant forms of finance that respondents had used were payments from clients as the work proceeded (mean=3.90) and deposits from clients (mean=3.74). The forms of finance that were least used were finance from micro-lenders (mean=2.35) and insurance pay-outs (mean=2.16).

<table>
<thead>
<tr>
<th>Source</th>
<th>Mean</th>
<th>Std Dev</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Payments as work is completed</td>
<td>3.90</td>
<td>1.35</td>
<td>1</td>
</tr>
<tr>
<td>Deposits from clients</td>
<td>3.74</td>
<td>1.55</td>
<td>2</td>
</tr>
<tr>
<td>Personal savings as a source of financing projects</td>
<td>3.27</td>
<td>1.48</td>
<td>3</td>
</tr>
<tr>
<td>Loans from banks</td>
<td>2.81</td>
<td>1.49</td>
<td>4</td>
</tr>
<tr>
<td>Finance from micro-lender</td>
<td>2.35</td>
<td>1.28</td>
<td>5</td>
</tr>
<tr>
<td>Insurance pay outs</td>
<td>2.16</td>
<td>1.46</td>
<td>6</td>
</tr>
</tbody>
</table>

### Importance of sources of finance

From Table 7 it is evident that respondents regarded financial institutions (mean=4.20), personal savings (mean=4.20) and ploughing back of profits (mean=4.10) as the most important sources of finance for their construction businesses. They reported that donor agency funding in the form of special aid (mean=2.97) as the least important source of finance. Franchising
(mean=3.03) and government assistance (mean=3.97) were also reported as not being important finance sources.

10. CONCLUSION

The study sought to explore the challenges and barriers facing contractors registered with the Construction Industry Development Board (CIDB) in Grades 2-4 with emphasis on the impact of their lack of financial skills on the sustainability of their businesses. The results from the survey show that the most important success factor for construction businesses was prompt payments by clients which enabled continuity on a project. Sound financial management together with proper bookkeeping knowledge contributes to a successful construction business. Poor strategic leadership as well as lack of due diligence were the main factors that caused business failures resulting in the delays in program, increased project costs and severe disruptions to a project. Corruption, lack of finance and inflexible labour laws although not the main causes of contractor failure were highlighted. The contractors were knowledgeable in project management and their target market. However their knowledge of legal structures for ventures, finance and accounting procedures was lacking. Payments as the work was completed and deposits from clients were found to be the dominant form of finance used by contractors on their projects. This enabled continuity on their projects as well as the likelihood of sustaining their businesses. Contractors also used their personal savings as a source for financing projects. Lack of knowledge of key business concepts such as income statements, balance sheet, finance and accounting contributed to poor performance and financial management and the use of loans from banks. Sources of finance were predominantly from financial institutions. Additionally their inability to furnish the financial institutions with collateral and audited financial statements also contributed to the low levels of borrowing. Break-even point analysis was of medium to low importance and this is due to the contractors knowledge and understanding thereof. Personal savings is therefore the alternative method of financing projects. Financing options of donor agencies, franchising and government assistance is very much a last resort source of financing used by contractors. Ploughing back profits in addition to financial institutions and personal savings as a source of finance is also popular. The main conclusion is therefore financial management skills is lacking among contractors and is the main contributor to contractor sustainability.

11. REFERENCES

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A Field Study Investigating the Role of Corporate Social Responsibility as a Marketing Strategy in Branding Architecture Design Firms in Developing Countries

Ayman A. E. Othman¹ and Mai G. Hafez²
Architectural Engineering Department
Faculty of Engineering
The British University in Egypt (BUE)
El Shorouk City - Cairo Suez Desert Road
Postal No. 11837 - P.O. Box 43
Tel.: (+202) 26890000
E-mail¹: ayman.othman@bue.edu.eg
E-mail²: mai.hafez7@gmail.com
Orcid.org/0000-0001-9842-3885
Orcid.org/0000-0002-7282-205X

ABSTRACT AND KEYWORDS
Purpose of this paper
This paper aims at analysing the results of a field study, conducted by the authors, to investigate the role of Corporate Social Responsibility (CSR) as an innovative marketing strategy for branding Architectural Design Firms (ADFs) in developing countries.

Design/methodology/approach
To achieve the previous aim, a research methodology is designed to accomplish three objectives.

1. Reviewing literature related to the research topic through discussing the current marketing strategies in ADFs and their limitations, CSR and highlighting the relation between CSR, branding ADFs in developing countries.

2. Presenting three case studies of selected ADFs that have included CSR in a part of their marketing strategies; to investigate their marketing tools and their effectiveness in branding ADFs.
3. Investigating the perception and application of ADFs towards adopting CSR as a marketing strategy through conducting a survey questionnaire and semi-structured interviews with a representative sample of ADFs in Egypt.

**Findings**
ADFs are not well acquainted with the essence of marketing for their businesses. Due to the ineffectiveness of current marketing strategies, ADFs need to adopt creative marketing strategies such as CSR to adapt to the expanding business in construction, the economic recession as well as promoting the identity of ADFs.

**Research limitations**
The research was conducted in Egypt as an example of developing countries.

**Practical Implications**
This research proposes CSR as an effective marketing strategy for branding ADFs in developing countries. This will help improving the performance and profitability of ADFs.

**Research original/value of paper**
The research is an addition to the study of marketing strategies in ADFs, as it adds CSR as an innovative method to overcome the deficiency of the current marketing strategies in this field.

**Keywords:**
Corporate Social Responsibility, Architecture Design Firms, Branding, Marketing Strategies.

1 **INTRODUCTION**

Current marketing strategies of ADFs are insufficient in developing countries. So new approaches like Corporate Social Responsibility that considers the community and the environment as one of the main stakeholders are needed (Murray, 2009). Architects are responsible for enhancing the community within which they operate in order to satisfy the stakeholders as a whole, with objectives that go beyond maximizing profits. Furthermore, developing countries suffer from many problems such as poor health conditions, poor sanitation, poor education system, and facilities, etc. These problems could be solved by proper design and planning provided by ADFs. However, ADFs are reluctant to enhancing these communities’ conditions due to the lack of proper fund using the traditional methods. The CSR activities provide an innovative solution to these communities, while no big funds are required; and an opportunity for
ADFs to brand themselves as socially responsible to be able to meet up with the clients’ expectations. Thus, the aim of the paper is to present a field study that investigates the role of CSR as an innovative marketing strategy for branding ADFs in developing countries.

2 RESEARCH OBJECTIVE AND METHODOLOGY

In order to achieve the above-mentioned aim, a research methodology consisted of literature review, case studies, survey questionnaire and semi-structured interview, is designed to achieve three objectives. Firstly, build a comprehensive background on the topics of discussion. Secondly, analyse three case studies that were selected for including CSR in their marketing strategies. Finally, prepare a survey questionnaire to be handed over to a representative sample of architects to answer; along with a semi-structured interview with a representative sample of managers in ADFs.

3 LITERATURE REVIEW

3.1 Current Marketing Strategies in ADFs and their limitations

In order to plan and implement a marketing strategy for an ADF, some steps should be followed such as defining the mission and vision statement of the ADF, then developing an action plan in order to apply the previous statements; while considering the planned and allocated budget (Epead & Othman, 2014). However, Butković et al. (2010) stated slightly different steps to conduct a marketing strategy which indicates that an analysis of the current position of the firm should first be evaluated; then define the objectives for what the future position of the firm should look like while examining if the set objectives are in the best interest of the business or not. Then, the method of achieving the set objectives should be studied and determined. On the other side, Frown et al. (1990) considered Architecture as a service providing business as opposed to product providing business. Moreover, Nickels (1990), the award-winning teacher and author of Understanding Business, classified the marketing functions as Differentiation function, Segmentation Function, Contactual Function and Communication Function is considered as the most important one of them. In addition to the segmentation function, contactual function and valuation function. Although Nickels (1990) created a new classification for the marketing functions, but he thought that the traditional strategies could be used as well but only as facilitating functions. However, these strategies were proven insufficient due to many reasons. One of the reasons is that clients are now highly aware of the consequences of their purchasing practices on the society and are causing massive changes in the customer
expectations that businesses were previously considering (Golob, 2015). The Global CSR study (2015) confirmed the claim that consumers are not only expecting companies to act responsibly toward the society but also embracing the concept on their own personal responsibility as individuals of the community. This highlights a weakness point in any company that neither take CSR seriously nor integrates its main concepts within their corporate strategy, including the ADFs. Another reason is that ADFs misrepresent themselves, by promoting themselves for what potential they see in their skills, and not for the current or existing skills on their hands. Some ADFs face this problem when designing their own marketing strategy, especially if they do not have marketing specialists and only assign this task to one of the staff in a small to medium ADF. Thus, this leads to either missing opportunities of working on small projects that might be more profitable or leads to the ADF being involved in a large project that exceeds its capabilities, which might eventually cause failure of this project ruining ADF’s reputation (Mitrache, 2012).

3.2 Corporate Social Responsibility

CSR could be viewed as a social obligation, which includes the obligation to be productive and sustainable to the economy; also, comprises the obligation to abide by the rules, norm and values of the community. The social obligation is based mainly on the concept of giving back to the community (Carroll, 1979 cited in Maignan et al., 2004). However, this obligation was criticized for lacking the precision needed in the management of CSR (Maignan, 2004). This led to CSR being viewed as stakeholder obligation; because the corporate should not be held responsible for the whole community but should take into consideration the stakeholders’ interests only, in the form of organisational stakeholders, community, and media as agreed upon by Wood (1991) and Jones (1991 cited in Maignan, 2004). However, Swanson (1995) felt the urge to add the ethical consideration of the CSR by specifying the importance of having a positive impact on the society. Also, the need to independently judge the ethical performance of the organisation disregarding the consequences on the stakeholders was one of the motives to include the ethical obligation in the CSR. On the other hand, Jones (1995) believed that ethics should not be considered as an obligation in the first place, as this eliminates the chance to evaluate the standardized criteria upon which the business practices could be categorised as socially responsible (Maignan, 2004).

3.3 The Relationship between CSR, Marketing, and Architecture

Past studies did not contribute much to the integration of marketing and the socially responsible acts within the organization (Maignan, 2004).
However, Andreasen (1994) highlighted the emergence of the social marketing concept and the significance of integrating the marketing activities along with the socially responsible goals (Maignan, 2004). Marketing strategies should be designed to reflect to and fulfil customer needs; whether they are known needs or unspoken needs that require research and studies. When the Global CSR studies prove that the consumers' awareness levels of social responsibility (Cone, 2015), then it is understood that CSR should be used in the marketing of ADFs.

4 CASE STUDIES

4.1 Takween Integrated Community Development (Takween ICD)

Geneina in Action is a project by Takween ICD in 6th of October city, Egypt. The main aim of the project is to transform a public place into a garden for the Egyptian residents along with the Syrian and Sudanese refugees in Masaken Othman buildings. The project owes its success to the collaboration of multiple entities at different stages such as the UNHCR team, the governmental organizations, local NGO's and art groups. Although the process invested a long time in the meetings and interview with the local community, however, this was the guarantee on the project's success and approval by its users. The participation of people at every stage of the project developed a sense of ownership, which has made them keen on preserving it; as shown in figure (6.1) where kids were invited into participatory design sessions to design their own playing elements.
However, this collaboration was the result of integrating CSR into Takween's policy in the first place. As the social concern for the refugees and underprivileged Egyptians was the main reason an entity such as the UNHCR or the German cooperation would be interested in funding such projects. These entities not only funded the project but also helped in resolving several conflicts with the governmental organizations. This case proves that when CSR is used in the marketing strategy of architectural projects, an international reputation could be gained. This reputation is used to attract more clients, both nationally and internationally. In addition, participatory approaches provide the firm with the required knowledge about different districts and communities to guarantee the project's success (Takween ICD, 2014).

4.2 HWKN (Hollwich Kushner)

HWKN is an architectural design firm in New York. Their projects are characterized by being rich in individual personality, local context, and highly social experiences; with the aim of creating an emotional bond between people and their built environment. Their target is to combine the culture, branding and development concepts all together to shape the future of architecture (Kushner & Hollwich, 2013). The Fire Island Pines in New York State was a community centre. The proposed design by HWKN was bold in its form and different from what the community was used to. This is why the architect, as well as the client, were both scared that the people might not like it when it is done (Kushner & Hollwich, 2013). They created an album of realistic renderings for the building and uploaded it into social media in order to involve the public in the decision-making process on whether they like the design or not. As shown in figure (7.2), the rendered images of the new design were uploaded.
They let the people share the album online and say their opinion about this building. As a result, the building was perceived as a part of the community two years before its completion. The public is looked upon as the main factor that determines the success of any project. This highlights the role of social responsibility in the architectural engineering industry. Thus, in order to ensure the success of projects, a two-way communication channel should be maintained to allow for the public feedback on the proposed designs before they are implemented in reality and changes are then inapplicable anymore. Thus, considering the people's opinion enhances the probability of the project's success, and clients are attracted to successful ADFs. In addition, reaching out to the public expands the targeted segment to include more potential clients.

4.3 Ramses Wissa Wassef Architecture

The architect's interest in the development of the traditional crafts of the residents of El Haranya village was the main motive for constructing El Haranya Arts Centre. He even used this characteristic in the marketing process of his project. His branding strategy depended on presenting how naturally talented are those kids in expressing their own minds with no adult interference. The public participation as an approach was a success in the weaving workshops. He decided to implement it in the architecture of the centre. The main aim of this gesture was to teach the locals how to build using mud bricks and sand, as these available materials would be their alternative instead of having to purchase building materials. The architect was generally concerned with enhancing the standard of living of the inhabitants of El Haranya through the experimentation and implementation of his theories. The training provided to the weavers and
the builders created a talented team that would enhance the competitiveness of the arts centre, as well as improving the residents' skills regarding these fields. Choosing the activity or the type of projects with respect to the traditions and cultures of the locals is one of the main factors that guarantee the success of the project. Moreover, taking an interest in enriching the locals' skills, and giving them the chance to be creative while expressing their own minds, would generate unique outcomes that would definitely enhance the project's branding position. In addition to the branding position, the standard of living of these residents' would be improved, allowing them to feel pride in what they do; thus, motivating them to be more productive. The socially responsible projects that are concerned with improving the residencies of their workers to fit their requirements generally guarantee the loyalty of the workers, which reflects a successful business image.

5 DATA ANALYSIS

5.1 Response Rate

The sample size consisted of 44 ADFs in Egypt, 32 ADFs out of the 44 ADFs responded to the survey questionnaire. This represents 72.7% of the sample size as the response rate. The semi-structured interviews were planned to be conducted with 5 managers in ADFs. However, due to the time constraint of their schedules, three interviews only were conducted. Although, this only represents 60% of the targeted sample; those 3 interviews provided adequate information on the topic in question.

5.2 Analysis of Survey questionnaire

65.6% of the ADFs clients are local, which means that these ADFs are not abided by any international regulations about social responsibility. The architects in 46.9% of the ADFs are unaware of their firms' strategies and visions. None of the surveyed ADFs has any of the social responsibility aspects in their visions. 65.6% of the architects are unaware of the firm's reputation and image. Thus, they are unaware of the significance of the firm's image in the marketing process.

31.3% of the respondents are well acquainted with the meaning of CSR and its aspects. However, the CSR is not included in their strategies or visions. On the other hand, 37.5% of the respondents are moderately interested in participating in socially responsible activities and projects. This reflects the influence of the obstacles that hinders the actual application of socially responsible projects. Most of the architects in the sample believe that clients choose the ADF based mainly on the history of
the firm’s built projects, while the firm’s social responsibility came fifth in the significance, see table (9.1) and figure (9.3).

<table>
<thead>
<tr>
<th>Basis for Choosing ADFs (BC)</th>
<th>Abbreviations</th>
</tr>
</thead>
<tbody>
<tr>
<td>History of Built Projects</td>
<td>BC1</td>
</tr>
<tr>
<td>Experience in the project sector type</td>
<td>BC2</td>
</tr>
<tr>
<td>Firm’s Reputation</td>
<td>BC3</td>
</tr>
<tr>
<td>History of Proposed Projects</td>
<td>BC4</td>
</tr>
<tr>
<td>Firm’s Social Responsibility</td>
<td>BC5</td>
</tr>
<tr>
<td>Individual Architects’ Skills</td>
<td>BC6</td>
</tr>
<tr>
<td>Firm’s Vision</td>
<td>BC7</td>
</tr>
</tbody>
</table>

However, the majority of respondents agreed upon the high influence of CSR on creating a better reputation for ADFs. Although 31.3% of respondents agreed upon understanding the CSR aspects, 71.9% of them agreed upon considering their lack of experience in this field an obstacle that hinders the firm from engaging in this type of projects, see figure (10.4).
75% of respondents are interested in engaging in socially responsible projects, with actual involvement in the practices not just as an image for publicity; while 65.6% of the architects in the sample agree upon the success of involving CSR as a marketing strategy for ADFs.

5.3 Analysis of Semi-Structured Interview

Managers in the interviews agreed upon the significance of having long-term strategies and visions. However, they admitted their lacking of proper communication channels to communicate these visions to their employees. The marketing functions significance is still underrated, as the managers claimed they do not have a marketing department. Even ADFs that have a business development team still lack a full-time team dedicated to managerial tasks. Managers in ADFs claim that architects in their firms are well acquainted with the CSR aspects, however, they confirmed the findings of the survey questionnaire that they lack the experience needed for the application of these aspects in real projects. However, the lack of application experience is not the only obstacle from the managers' point of view. They believe that the involvement in CSR requires many responsibilities in terms of financial concerns that they might not be able to afford. Thus, they believe that the success of a marketing strategy that integrates CSR aspects depends on the involvement of governmental plans. These governmental plans would include prioritizing firms with socially responsible activities in terms of project offers, marketing facilities, etc.

5.4 Summary of Findings

Architects lack of awareness about their firms' strategies and visions highlight an obstacle in integrating CSR as a marketing strategy for ADFs; because this integration must involve good communication of the firms' visions and strategies to the architects. Although, the architects believe in the importance of CSR in creating a successful business image, but they also know that the clients' current awareness levels in Egypt as a developing country might jeopardise the success of this image; as the clients might be more interested in lower prices rather than social responsibility. On one side, the architects in the sample are well aware of the CSR aspects; however, they believe they need to understand how to apply these aspects in real projects. The current marketing strategies for start-up ADFs depended heavily on the word of mouth and the appearance in exhibitions, which still proved insufficient to provide them with the needed publicity. The managers of ADFs believe that for the CSR to be integrated into the marketing strategies of ADFs, governmental plans involvement is necessary.
6 CONCLUSIONS AND RECOMMENDATIONS

This paper presented an addition to the original body of knowledge by studying the deficiencies of the current marketing strategies, and the improvements that could be achieved by integrating the CSR in the marketing strategy of ADFs. In addition, the paper presented a field study for the role of CSR when integrated into the marketing strategies of ADFs in developing countries. The research recommendations are directed at the government to provide incentives for ADFs engaging in CSR activities that enhance the living conditions of communities in developing countries. In addition, recommendations are for conducting further research in the areas of marketing strategies in ADFs, to add value to the original body of knowledge.

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Assessing the understanding of SMEs of standard forms of contract in South African construction

Theo C. Haupt1 and Ronelle Dulu2
Haupt@ukzn.ac.za 1 and dulur@mut.ac.za 2

1 Professor, Construction Studies Program, University of KwaZulu-Natal, Howard College, Durban 4001, South Africa. (Tel: +27 31 2602712)

2 Visiting Research Professor, Department of Construction Management and Quantity Surveying, Mangosuthu University of Technology, Umlazi, Durban 4026, South Africa. (Tel: +27 31 9077557)

ABSTRACT AND KEYWORDS

Purpose: This study attempts to identify the underlying reasons for the poor understanding of SMEs of standard forms of contracts commonly used in the South African construction industry. The identification of these reasons will enable a strategy to be developed that will improve the understanding of contracts and thereby improve the overall performance of SMEs on construction projects.

Design/methodology/approach: A sample of 30 SME contractors was surveyed in the Durban area of KZN using the Master Builders Kwazulu-Natal and Construction Industry Development Board (CIDB) databases.

Research limitations: The sample of 30 SMEs was drawn from the KwaZulu-Natal province of South Africa.

Findings: Preliminary findings suggest that commonly used standard forms of contract are textually complex particularly making the clauses dealing with payment, performance and consequences of delays and default difficult to understand.

Response to conference theme: The evaluation of the contractual environment with emphasis on the SME sub-sector of the industry in South Africa will lead to improved and innovative approaches to standard form of contract development.
Practical implications: The findings are indicative of potential improvement of the understanding of standard forms of contract and consequent improved performance of SMEs in construction.

Keywords: Standard forms of contract, textual complexity, SMEs

Conference sub-theme: Construction Education

1. INTRODUCTION

A contract is complex and can impose a significant cognitive load on the contracting parties making it difficult to understand (Eggleston, Posner and Zeckhauser, 2000). Standard forms of contract probably account for more than 99% of all contracts entered into (Slawson, 1971). Arguably, most contracting parties would have difficulty remembering the last time when they contracted other than by standard form. The practice of parties choosing the language and terms of their entire agreement is not much more than of historical importance (Ibid). The predominance of standard forms is the best evidence of their necessity and importance. A standard form of contract always uses the written form and its terms are prepared in advance. It is usually submitted in this form by one of the contracting parties to the other, typically the client to the other party usually a contractor. Model or standard forms of contract are intended to be used between parties of equal bargaining power and, in the course of the negotiations, are frequently amended in order to achieve a balance of, for example, economic interest between the contracting parties (Eggleston, Posner and Zeckhauser, 2000). But is this in practice the case?

Complete model or standard forms of contracts aim at total standardization. They purport to deal with all or most relevant terms of the contract between the parties. In normal cases only the names of the parties, the price and the specification of the goods or services to be rendered are left blank and have to be inserted. The parties, in the exercise of their discretion, are free to agree on modifications of the contract terms. This type of standardisation attempts to cover the rights and duties born of the contractual relationship, from formation at one end of the scale to such matters as discharge, rescission and remedies for breach of contract on the other. Because of standardization vast numbers of contracts are executed to the reasonable satisfaction of all parties concerned. People and organizations bargain, they write documents, and they avoid, suppress, and resolve disputes.

Further, because of standardization, it is likely that parties do not read the contract in its entirety or only read it after being bound by its terms (Slawason, 1971). In practice, however, many contracts are quite simple
and the terms are easy to understand (Eggleston, Posner and Zeckhauser, 2000).

2. CHALLENGES

In the South African Construction Industry, standard forms of contracts have been developed by independent professional bodies in order to provide some uniformity through standardization of the contractual terms and conditions. These contracts have been designed to specifically cater for the special circumstances relating to construction. According to Pietroforte (1997), standard forms of contract conventionalize the construction process through an assumed set of pre-established phases, responsibilities and roles. Therefore, the intent of model contracts is to create a predictable project environment and establish a common context of understanding and meaning among the contracting parties so that procedural certainty can be improved.

The intention for the development of particular standard forms of contract to be used in the public sector by the Construction Industry Development Board (CIDB) was to enhance the growth and development of SME contractors in the South African Construction industry. SME contractors are contractors that were disadvantaged under the pre-democratic period, namely pre-1994). The South African construction industry faces unique challenges due to its history. The primary challenge faced was that it was estimated that half of the workforce was unemployed, the majority of whom had no skills and minimal education (Kambuwa and Wallis, 2002). Having identified this challenge, the South African government resolved that along with the benefit of basic infrastructure that is much needed in the country, the overall economic benefit would be the provision of construction jobs, improvement of work productivity and the growth of small and medium construction enterprises (McCutheon, 2002).

Studies have shown that the lack of clarity in contract documents can lead to misunderstanding between parties and even disputes (Cheung & Yiu, 2007; Harmon, 2003). If disputes are not properly managed, they may cause project delays, undermine team spirit, increase project costs, and, above all, damage continuing business relationships (Chan and Suen, 2005).

The rights and obligations of the contracting parties are communicated through the conditions of contract used in a construction project to ensure mutual and shared understanding of these by them. The contractual obligations and needs in any contract will be questionable and possibly contentious if there is a lack of understanding of the terms and interpretation of the provisions of the contract document. This
misunderstanding could potentially lead to the non-fulfilment of contractual obligations. Broome & Hayes (1997) attribute interpretation errors mainly to contract clarity and legalese. It is essential to have a proper understanding of the contents of the contract document which ultimately leads to the enhancement of the contractual relationship between the parties and ensures the deliverance of the intended product. The complex design, structure and language usage of contract documentation in a construction contract often hinders the contract parties, especially the contractor and more particularly the SME contractor to really understand the contractual obligations and needs.

**Factors that inhibit the understanding of contract documentation**

Clearly written communication aids the understanding of construction contracts resulting in less disputes arising (Rameezdeen and Rodrigo, 2013). The contract stipulates privileges and commitments as well as procedures to be followed by the respective contracting parties (Ndekugri, et al. 2007). Conditions of contract need to be both readable and comprehensible for determining the contract’s effectiveness in practice (Broome & Hayes 1997; Chong, et al., 2011). When the readability of a contract of a contract clause is high, its comprehension by different readers is also high (Rameezdeen and Rajapakse, 2007). Research, using surveys, shows that contract conditions used in construction lack clarity Bunni, 2003; Chong & Zin 2010; and Rameezdeen and Rodrigo, 2013). To make matters worse standard forms of contract have become more complex over time (Rameezdeen and Rodrigo, 2013). According to Broome and Hayes (1997) lack of clarity in traditional contract conditions is mainly attributable to long sentence length, poor layout and the presence of many redundant legal expressions.

Broom and Hayes (1997) note that standard forms of contract used in construction are plagued with many problems; lack of clarity is the most significant. By lack of clarity, the authors mean the design and layout of the whole contract document, as well as the use and order of words within a sentence (Broom & Hayes 1997). Bubshait and Almohawis (1994) define clarity as the ease with which the language of the conditions can be understood.

Other problems included the use of legal jargon – sometimes referred to as legalese. The primary users of contract documents are contract administrators, project managers, quantity surveyors, architects and engineers who do not come from a legal background (Wright & Ferguson, 2009). The major issue is the difficulty of use of contract documents by non-legal professionals, who are in fact the main users (Ali & Wilkinson, 2010). As legal professionals are typically not employed on day-to-day
contract administration of a construction project, there has been a plea to make these documents readable (Ibid).

**Consequences of poor understanding**

The contract document is the main vehicle through which a pre-contract business deal is conveyed through to the implementation stage of a project. (Bubshait & Almohawis, 1994). If there is a lack of comprehension and understanding of the contract document, this lack will lead to the failure of the project. According to Bresnen and Marshall (2000) lack of clarity and understanding can negatively affect the relationship between clients and contractors. In a contract document there are stipulated completion dates which have to be complied with. Failure to comply with these dates will likely result in penalties which will affect the financial status of the contractor or may even result in the liquidation of the contractor. There are also other requirements such as for example, those regarding security and payments which are critical. If contractors do not have a clear understanding of their obligations, this deficiency will impact negatively on their sustainability as contractors.

3. **RESEARCH APPROACH**

A convenience sample was surveyed comprising of 30 Small Medium Enterprise (SMEs) contractors in the Kwazulu-Natal province of South Africa about their views on their use and understanding of standard forms of construction contracts that they had encountered on projects. Participants in the study were selected from construction projects in the Durban area and who were willing to participate. The data was collected via a quantitative questionnaire survey comprising of a section containing 22 factors and influences about standard forms of contracts to which respondents were required to give a scaled response of agreement. There was a section designed to identify the most commonly used forms of contract. Descriptive statistics were derived using SPSS v23 and presented including measures of central tendency and dispersion. The internal validity of scaled responses was determined by the Cronbach’s alpha co-efficient for validity.
4. RESEARCH FINDINGS

Profile of respondents

Most respondents had worked in the construction industry for between 1 and 10 years (65.5%). More than half of the respondents (51.7%) have CIDB gradings for between 1 and 10 years as follows:

- Grade 1 – 31.3%,
- Grade 2 – 37.5%,
- Grade 3 – 12.5%,
- Grade 5 – 12.5%; and
- Grade 7 – 6.3%.

Reliability

The Cronbach’s alpha co-efficient for the scaled responses indicates an acceptable degree of internal consistency for the scales used, namely a Cronbach Alpha statistic which is greater than the rule-of-thumb 0.70 for acceptable internal scale consistency. There is therefore 92.0% probability that the construct measures a single underlying concept with an error of at most 5%. The scale used is therefore acceptable in measuring of the reliability of the construct.

Views on standard forms of construction contracts

Respondents were requested to indicate on a 5-point Likert scale where 1 = strongly disagree, 2=disagree, 3=neutral, 4=agree and 5 = strongly agree, the extent to which they agreed with statements about the features of standard forms of contract. Their responses ranked by the means are shown in Table 2.

Table 2. Views on standard forms of construction contracts (n=30)

<table>
<thead>
<tr>
<th>Features of forms of contract</th>
<th>Mean</th>
<th>Std Dev</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contracts establish common understanding of legal duties and obligations</td>
<td>4.10</td>
<td>1.24</td>
<td>1</td>
</tr>
<tr>
<td>Contracts try to cover every possible situation</td>
<td>3.97</td>
<td>1.27</td>
<td>2</td>
</tr>
<tr>
<td>Contract documents are always complete</td>
<td>3.93</td>
<td>1.31</td>
<td>3</td>
</tr>
<tr>
<td>There are too many clauses</td>
<td>3.87</td>
<td>1.43</td>
<td>4</td>
</tr>
<tr>
<td>Contract clauses lack clarity</td>
<td>3.82</td>
<td>1.22</td>
<td>5</td>
</tr>
<tr>
<td>Too many modifications to existing clauses</td>
<td>3.80</td>
<td>1.32</td>
<td>6</td>
</tr>
<tr>
<td>Contract document is too long</td>
<td>3.70</td>
<td>1.34</td>
<td>7</td>
</tr>
<tr>
<td>Tend to be too formal</td>
<td>3.57</td>
<td>1.33</td>
<td>8</td>
</tr>
<tr>
<td>There seems to be too much repetition</td>
<td>3.41</td>
<td>1.24</td>
<td>9</td>
</tr>
</tbody>
</table>
Standard forms of contract have too much detail 3.35 1.47 10
Too much legalese is used 3.33 1.35 11
The allocation of risks is unfair 3.31 1.51 12
Too many redundant legal expressions 3.23 1.36 13
Too many revisions create confusion 3.23 1.36 13
Sentences are too long 3.13 1.38 15
Difficult to understand/comprehend 2.96 1.26 16

Table 2 Continued

<table>
<thead>
<tr>
<th>Features of forms of contract</th>
<th>Mean</th>
<th>Std Dev</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Difficult to read</td>
<td>2.93</td>
<td>1.31</td>
<td>17</td>
</tr>
<tr>
<td>The layout of the contract documents is poor and confusing</td>
<td>2.90</td>
<td>1.14</td>
<td>18</td>
</tr>
<tr>
<td>The clauses are unfamiliar</td>
<td>2.90</td>
<td>1.35</td>
<td>19</td>
</tr>
<tr>
<td>The use and order of words in sentences is unclear</td>
<td>2.90</td>
<td>1.45</td>
<td>20</td>
</tr>
<tr>
<td>There is too much ambiguity</td>
<td>2.89</td>
<td>1.20</td>
<td>21</td>
</tr>
<tr>
<td>Contracts are designed to be only understood by experts</td>
<td>2.83</td>
<td>1.53</td>
<td>22</td>
</tr>
</tbody>
</table>

Respondents strongly agreed that contracts established common understanding of legal duties and obligations with respect to construction projects (mean=4.10). They also tended to strongly agree that contracts attempted to cover every conceivable situation on a construction project (mean=3.97), contract documents were always complete (mean=3.93), contracts had too many clauses (mean=3.87), and contracts lacked clarity (mean=3.82).

Table 3. Use of standard forms of construction contracts (n=30)

<table>
<thead>
<tr>
<th>Forms of contract</th>
<th>Yes %</th>
<th>No %</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>OTHER (NHBRC)</td>
<td>90.0</td>
<td>10.0</td>
<td>1</td>
</tr>
<tr>
<td>JBCC</td>
<td>66.7</td>
<td>33.3</td>
<td>2</td>
</tr>
<tr>
<td>GCC</td>
<td>33.3</td>
<td>66.7</td>
<td>3</td>
</tr>
<tr>
<td>NEC</td>
<td>26.9</td>
<td>73.1</td>
<td>4</td>
</tr>
<tr>
<td>MBA</td>
<td>25.9</td>
<td>74.1</td>
<td>5</td>
</tr>
<tr>
<td>FIDIC</td>
<td>11.1</td>
<td>88.9</td>
<td>6</td>
</tr>
</tbody>
</table>

From Table 3 it is evident that the NHBRC was the most frequently used standard form of contract (90%) followed by the JBCC (66.7%).

Table 4. Difficulty of use of standard forms of construction contracts (n=30)

<table>
<thead>
<tr>
<th>Forms of contract</th>
<th>%</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>JBCC</td>
<td>36.4</td>
<td>1</td>
</tr>
<tr>
<td>NEC</td>
<td>27.3</td>
<td>2</td>
</tr>
<tr>
<td>MBA</td>
<td>18.2</td>
<td>3</td>
</tr>
<tr>
<td>GCC</td>
<td>9.1</td>
<td>4</td>
</tr>
<tr>
<td>FIDIC</td>
<td>8.1</td>
<td>5</td>
</tr>
</tbody>
</table>
From Table 4 it is evident that the JBCC was the most difficult form of contract to use (36.4%). The NEC form of contract was the next most difficult to use (27.3%). All respondents reported that they had not received any prior training in any of the standard forms of contract.

5. CONCLUSION

The study assessed the understanding of standard forms of contracts in South Africa. Generally, the findings echoed those reported in the literature with contracts being found to be difficult to understand because they lacked clarity exacerbated by them having too many clauses. It is evident that there are various other factors that impede the understanding of the contract documentation. It is likely that the lack of understanding could be related to contractors not having any prior or proper training in contract document interpretation.

Further, the JBCC which is the most commonly used form of contract in South Africa in both the private and public sectors apart from the NHBRC contract was found to the most difficult form of contract to use followed by the NEC which is less frequently used.

6. REFERENCES


Marvin Kambuwa and Malcolm Wallis November, 2002 Performance Management and Integrated Development Planning in South Africa
Rameezdeen, E. and Rodrigo, A. 2013. ‘Textual complexity of standard conditions used in the construction industry’ Australian Journal of Construction Economics and Building, 13 (1) 1-12
Predictors of obtaining full credit from financial institutions: A case of Small and Medium Enterprises in South Africa Construction Industry

Olanrewaju A. Balogun¹, Justus N. Agumba², and Nazeem Ansary³

¹Department of Construction Management and Quantity Surveying, University of Johannesburg corner Siemert and Beit Streets, Doornfontein, 2028, Johannesburg, South Africa, lbalogun@uj.ac.za, Tel No. + (27) 115596896
²Department of Construction Management and Quantity Surveying, University of Johannesburg corner Siemert and Beit Streets, Doornfontein, 2028, Johannesburg, South Africa, jagumba@uj.ac.za, Tel No. + (27) 115596488
³Department of Construction Management and Quantity Surveying, University of Johannesburg corner Siemert and Beit Streets, Doornfontein, 2028, Johannesburg, South Africa, nansary@uj.ac.za, Tel No. + (27) 115596049

ABSTRACT

Purpose of this paper
This paper focuses on determining the socio-economic and demographic factors that predict full credit accessibility from financial institutions (banks) in South Africa.

Methodology
Data was obtained through, questionnaire survey from 179 small and medium enterprises (SMEs) who were conveniently sampled. The questionnaire was developed from literature review. The socio-economic and demographic determinants predicting credit accessibility were identified. The data was analysed using statistical package for the social sciences (SPSS) version 22. Binary logistic regression analysis was used to analyze the predictors of obtaining full credit from banks.

Findings
The results indicate that full credit was predicted by age group, current position in the organization, tax number and location. The gender of the respondent, type of business ownership and collateral (security) did not predict credit being obtained in full.
Value
This study informs SMEs owners and managers to provide, their age, current position in the organization when applying for credit. Furthermore, they should provide the tax number and the location of the business in order for them to obtain full credit from banks.

Keywords: Determinants, Full Credit, Small and Medium Enterprises

1. INTRODUCTION

In the South African context in the construction industry, small enterprise is defined as having less than 50 employees, having an annual turnover of less than R5million, while medium enterprises have between 51 and 200 employees and less than R20million turnover (National Business Act, 2004). SMEs contribute immensely to the gross domestic product of most countries including South Africa.

Despite their importance to the economy in South Africa, small and medium construction enterprises (SME) sector is described as largely underdeveloped and lacking the managerial and technical skills and sophistication enjoyed by larger well established firms (Department of Public Works, 1999). Martin (2010) opined that lack of knowledge including knowledge of pricing procedures, contractual rights and obligations; law, management techniques and principles as well as technology were a challenge to SMEs.

Furthermore, SMEs are more likely to have limited formal education, which is based on a construction craft or trade training such as carpentry, plumbing, electrical installation and bricklaying. This training is probably in the form of learnership (CIDB, 2008). Past studies in South Africa revealed constraints and challenges of capacity and financial resources among SMEs (Fatoki, 2014; Agumba et al., 2005). Grimsholm and Poblete (2011) inferred that SMEs are not able to access finance or credit hence it stifles their growth and capability.

The concept of credit has been in existence as long as there has been civilization. It predates, by a considerable length of time the use of money, and written references to it appear as far back as in the code of Hammurabi, established around 1750 B.C. From its beginnings, credit has been used as a selling tool, to bind customers to a particular vendor and allow them to acquire more substantial goods for which they do not have the necessary capital (Mandell, 1994). The theory of credit emphasizes that financial institutions would be more willing to extend credit if, in case of default, they could easily enforce contracts by forcing repayment or seizing collateral. The amount of credit in a country would depend to some extent on the existence of legislation that protects the creditors’ rights on proper procedures that lead to repayment (Aduda, Magutu and Wangu, 2012).

The initial capital and expansion capital fund for South Africa construction SMEs has been a perpetual problem even though the
government continuously strives to empower this sector into the mainstream economy. Credit gap still exists between the supply capabilities of financing sources and the demand needs for capital for construction SMEs.

It is accepted that SMEs are a vehicle of economic empowerment in the construction industry in South Africa. However, they are phased with a plethora of challenges to be able to maximize their economic potential. Furthermore, construction SMEs find it difficult to access full credit they applied for. It can be unequivocally indicated that there is lack of studies to determine the predictors determining full credit and partial credit accessibility by construction SMEs. Based on this discussion this study is guided by two specific research questions and objectives: viz;

• What factors prevent construction SMEs from accessing credit? and
• What are the socio-economic and demographic predictors of full credit accessibility from financial institutions?

Therefore the objectives of the study are:

• To determine the factors that prevent construction SMEs from accessing credit; and
• To determine the socio-economic and demographic determinants predicting full credit accessibility from financial institutions.

2. LITERATURE REVIEW

2.1 Challenges preventing SMEs from accessing credit

According to Alhassan and Sakara (2014), results, the factors that stifle SMEs from accessing credit are, management expertise, high default rate and monitoring as the challenges banks faced in giving credit to SMEs. Bondinuba (2012) found that the key challenges that make it difficult for SMEs to access finance include policy regulation, inadequate financial infrastructure, stringent collateral security requirement, and lack of institutional capacity of SMEs sector. The key barriers identified include informational barriers, lack of managerial skills within SMEs. Nkuah, Tanyeh and Gaeten (2013) found that financial activities such as business registration, documentation/recording, business planning, asset ownership, impact heavily on SMEs access to bank credits.

Other challenges that SMEs encounter when trying to access finance can be due to an incomplete range of financial products and services, regulatory rigidities or gaps in the legal framework, lack of information on both the banks and the SMEs side. Banks may avoid providing financing to certain types of SMEs, in particular, start-ups and very young firms that typically lack sufficient collateral, or firms whose activities offer the possibilities of high returns but at a substantial risk of loss. There are many challenges to construction development and growth. These include policies
regulations, inadequate financial infrastructure, firm regulations, trade regulations, tax regulations, changing government policies, tax rates, corruption, labour regulations, cost of capital, and keen competition for limited opportunities (Uriyo 2004).

Kayanula and Quartey (2000) argued that factor like availability and cost of finance are the most common constraints faced by SMEs. Others are lack of collateral, informational barriers, regulations and rules that impede construction firms access to finance, the legal framework and policies around investment and financial institutions (FI’s) lending are fundamental, lack of access to appropriate technology, weak institutional capacity, lack of management skills and training in the construction firms, and lack of proper book keeping. The legal and regulatory frameworks that exist in Ghana also fail to provide the right support infrastructure to facilitate SMEs lending by the financial institutions. The lack of collateral, lack of proper financial management, lack of fiscal incentives for SMEs, strict prudential regulations which restrict flexibility of FI’s, unduly complex or onerous administrative procedures and even simply the lack of a consistent definition or enabling law for SMEs are some of the impediments to SMEs financing. Even though SMEs tend to attract motivated managers, they can hardly compete with larger firms.

Angela and Motsa Associates (2004) reviewed that entrepreneurs face several problems in their efforts to access finance, particularly from banks; viz., lack of collateral security, refusal to use own collateral, failure to make a remarkable own contribution, blacklisting, failure to review attractive financial records and/or business plans and high risk of small entrepreneurs.

Foxcroft et al. (2002) explicates that lack of collateral is the most widespread problem, particularly if the entrepreneur is applying for working capital. Other issues affecting the decision to provide finance include blacklisting, and inadequate financial records. The report concluded that, based on international comparisons, for a significant proportion of unsuccessful applicants, the failure of the application would not seem to be entirely unreasonable.

The Organization for Economic Cooperation and Development (OECD, 2006) argued that banks may avoid providing finance to certain types of SMEs, in particular, start-ups and very young firms that typically lack sufficient collateral, or firms whose activities offer the possibilities of high returns but at a substantial risk of loss (OECD, 2006). It can be suggested from these discussions that different set of challenges prevents SMEs from accessing finance. Hence, the importance of determining the challenges faced by SMEs in the South Africa construction industry from accessing credit.
2.2 Predictors of full credit accessibility

Fatoki (2014) in his study indicated that the availability of business plan, collateral, maintenance of a good relationship, managerial competency and a good credit score are critical lending requirements. In a study conducted by Kira and He (2012) in Tanzania, they found that there is interdependence and significant relationship between the firms characteristics i.e. location, industry, size, incorporation, age, size, availability of business information and collateral and access of debt to financing by SMEs.

According to Etonihu, Rahaman and Usman (2013) their findings suggested that education, distance to credit source and types of credit source as major factors that influenced farmers’ access to agricultural credit. In a study by Chauke and Anim (2013) in South Africa they established that access to credit was negatively influenced by educational achievement, investment in production costs, access to market information and membership of cooperative. In a separate study by Chauke et al., (2013) they found that the predictors for credit accessibility by smallholder farmers were, attitude towards risk, distance between lender and borrower, perception on loan repayment, perception on lending procedures and total value of assets. Ololade and Olagunju (2013) posited that gender, marital status, lack of guarantor, high interest rate predicted access to credit among rural framers in Nigeria.

Fatoki and Odeyemi (2010) results indicate that managerial competencies, business information, networking, location, crime, business size and incorporation are significant determinants of credit approval. Dzadze, Osei Mensah, Aidoo, and Nurah (2012), in their study established that extension contact, education level and saving habit had significant positive influence on farmers’ access to formal credit.

Kimutai and Ambrose (2013) opined that the key factors that influenced credit rationing by commercial banks in Kenya are loan characteristics, firm characteristics and observable characteristics. The study established that most of the banks rationed credit in order to reduce risk and to avoid the risk of adverse selection and moral hazard. Beck et al., (2008) found that banks in developing economies, compared to those in developed economies, tend to be less exposed to SMEs, hence charge them higher interest rates and fees. Musamali and Tarus (2013) inferred that profile such as ownership structure; size of the firm; business type; and age of the business indeed influence SMEs’ access to finance. Alhassan and Sakara (2014), results indicated that, the number of employees, experience in credit use and number of fixed assets possessed, attitude towards risk, business size, sector and form of business in the economy are the critical success factors in accessing bank finance. In a study by Pandula, (2011) using chi square as statistical parameter, found that, education of the entrepreneur and having membership with business association are associated with access to bank finance. In view of these discussions there
is no consensus of a set of determinants that will predict access to credit. Furthermore, no study has focused on full or partial credit accessibility from the financial institutions. Hence, this research poses the question: what are the socio-economic and demographic predictors of full credit accessibility from the financial institutions?

3. RESEARCH METHOD

A structured questionnaire survey was used to collect data. Creswell (1994) describes a survey as a quantitative or numeric description of some fraction of the population – the sample. Which enables researchers to generalize their findings from a sample of respondents to a population within the limitations of the sampling method. Convenience sampling was used which consisted of contractors registered with the CIDB. A total of 179 SMEs completed the questionnaire survey. Content validity was conducted on the questionnaire using pilot study administered to 30 construction SMEs.

SPSS version 22 was used to perform the binary logistic regression analysis. A binary logistic regression model with a dichotomous dependent variable of Yes or No was modelled. Yes response was defined as having accessed full credit and No accessed part of the credit. The dependent variable was coded as 1 and 0, for “Yes” and “No” respectively. The independent variables of the logistic regression model were also coded. They were the demographic and socio-economic characteristics of the SMEs: gender if male 1 and female 2; age group, 30 years and below 1, 31 years to 39 years 2, 40 years to 49 years 3 and 50 years and above 4; current position, director 1, owner 2, manager 3 and manager/owner 4; ownership, sole proprietorship 1, partnership 2, limited partnership 3, limited Liability company 4, corporation (for-profit) 5; tax number No, 0 and Yes, 1; location of business, city of Johannesburg Metropolitan Municipality 1, city of Tshwane Metropolitan Municipality 2, Ekurhuleni Metropolitan Municipality 4, West Rand District Municipality 4; collateral No, 0 and Yes, 1.

Logistic regression is recommended over linear regression when modeling dichotomous responses and allows the researcher to estimate probabilities of the response occurring (Hosmer and Lemeshow, 2004). The logistic regression equation takes the following form

\[ \ln \left( \frac{p}{1-p} \right) = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \ldots + \beta_k x_k \]

(1.1)

Where \( p \) is the estimated probability of passing, and \( x_1, x_2, \ldots, x_k \) are independent variables.

The estimated probability of the response occurring or passing \( (p) \) divided by the probability of it not occurring or not passing \( (1-p) \) is called the odds ratio. Maximum likelihood method is used to estimate the odds.
ratios of the model. Values of odds ratios higher than 1 indicate positive association between the variables, odds ratios equal to 1 indicate no association, while odds ratios lower than 1 indicate negative association between each independent variable and the dependent variable of the model.

Furthermore, in order for an independent variable to be a predictor of the dependent variable the p-value should be less than 0.05 at 95% confidence, which connotes its significance in the model. In achieving a fitting model the Hosmer-Lemeshow goodness of fit test should be significant i.e. the value should be greater than 0.05 (Pallant, 2013).

The factors preventing SMEs from accessing credit were measured using Likert scale of 1 to 5. 1 = Strongly disagree (SD), 2 = Disagree (D), 3 = Neutral (N), 4 = Agree (A), 5 = Strongly agree (SA). The Likert-scale questions are discussed based on their mean score in the interval scale. The difference between the upper and lower ends of the used scale is 4.0 since there are five points. Each range can be equated to 0.80 because the extent of the range is determined by a division between 4.0 and 5.0 (4/5). However, in the current study the intervals are as stated:

- > 4.21 ≤ 5.00 Strongly agree;
- > 3.41 ≤ 4.20 Agree;
- > 2.61 ≤ 3.40 Neutral;
- > 1.81 ≤ 2.60 Disagree;
- > 1.00 ≤ 1.80 Strongly disagree.

4. RESULTS AND DISCUSSIONS

Table 4.1 indicates that male respondents were the majority than female respondents, at 63% to 37% respectively. Majority i.e. 51% of the respondents were in the age group between 40-49 years old. Furthermore, 82% of the respondents were owners of the organizations surveyed. Majority i.e. 72% of the respondents had business experience of between 6 to 10 years. 98% of the SMEs are sole. Furthermore, majority i.e. 41% of the SMEs were located in the city of Johannesburg metropolitan.

<table>
<thead>
<tr>
<th>Gender</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>112</td>
<td>63%</td>
</tr>
<tr>
<td>Female</td>
<td>67</td>
<td>37%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Age group</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>30 years and below</td>
<td>2</td>
<td>1%</td>
</tr>
<tr>
<td>31-39 years</td>
<td>49</td>
<td>27%</td>
</tr>
<tr>
<td>40-49 years</td>
<td>92</td>
<td>51%</td>
</tr>
<tr>
<td>50 years and above</td>
<td>36</td>
<td>20%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Current position</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Director</td>
<td>29</td>
<td>16%</td>
</tr>
<tr>
<td>Owner</td>
<td>146</td>
<td>82%</td>
</tr>
<tr>
<td>Manager</td>
<td>3</td>
<td>2%</td>
</tr>
<tr>
<td>Manager/owner</td>
<td>1</td>
<td>1%</td>
</tr>
</tbody>
</table>
Continued Table 4.1 Profile of respondents and organization

<table>
<thead>
<tr>
<th>Experience of respondent</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-5 years</td>
<td>15</td>
<td>8%</td>
</tr>
<tr>
<td>6-10 years</td>
<td>130</td>
<td>72%</td>
</tr>
<tr>
<td>11-15 years</td>
<td>33</td>
<td>18%</td>
</tr>
<tr>
<td>16-20 years</td>
<td>1</td>
<td>1%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Ownership</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sole proprietorship</td>
<td>175</td>
<td>98%</td>
</tr>
<tr>
<td>Partnership</td>
<td>2</td>
<td>1%</td>
</tr>
<tr>
<td>Limited partnership</td>
<td>1</td>
<td>1%</td>
</tr>
<tr>
<td>Limited liability company (LLC)</td>
<td>1</td>
<td>1%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Location of company</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>City of Johannesburg metropolitan</td>
<td>74</td>
<td>41%</td>
</tr>
<tr>
<td>City of Tshwane metropolitan</td>
<td>42</td>
<td>24%</td>
</tr>
<tr>
<td>Ekurhuleni metropolitan</td>
<td>34</td>
<td>19%</td>
</tr>
<tr>
<td>West Rand district municipality</td>
<td>29</td>
<td>16%</td>
</tr>
</tbody>
</table>

Table 4.2 indicates that the SMEs respondents strongly agreed that lack of collateral, lack of cashflow statement and owners equity were hindering SMEs from accessing credit from financial institutions. The means were in the band of 4.21 to 5.00. The sector of the bussiness, lengthy and vigorous procedure for credit application, high interest rates, location of the business were in the band of 3.61 to 4.20 suggetsing that the respondents agreed that they contributed to their difficulty of obtaining credit. Furthermore, the SMEs responsdents disagreed that lack of appropriate education and training, and lack of managerial ability were hindering them from accessing credit. These two constraints were in the band of 1.81 to 2.60.

Table 4.2 Contraints in obtaining credit

<table>
<thead>
<tr>
<th>Constraints of credit accessibility</th>
<th>Mean</th>
<th>Stdev.</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lack of collateral</td>
<td>4.69</td>
<td>0.58</td>
<td>1</td>
</tr>
<tr>
<td>Lack of cash flow statement</td>
<td>4.51</td>
<td>0.98</td>
<td>2</td>
</tr>
<tr>
<td>Owner’s equity</td>
<td>4.39</td>
<td>1.01</td>
<td>3</td>
</tr>
<tr>
<td>Sector of the business</td>
<td>4.14</td>
<td>1.21</td>
<td>4</td>
</tr>
<tr>
<td>Lengthy &amp; Vigorous procedure for credit application</td>
<td>4.13</td>
<td>1.37</td>
<td>5</td>
</tr>
<tr>
<td>High Interest rates</td>
<td>3.81</td>
<td>1.51</td>
<td>6</td>
</tr>
<tr>
<td>Location of the business</td>
<td>3.76</td>
<td>1.27</td>
<td>7</td>
</tr>
<tr>
<td>Lack of good reference on integrity</td>
<td>3.03</td>
<td>1.66</td>
<td>8</td>
</tr>
<tr>
<td>Lack of awareness of existing credit schemes</td>
<td>2.97</td>
<td>1.71</td>
<td>9</td>
</tr>
<tr>
<td>A general lack of experience and exposure on construction project</td>
<td>2.75</td>
<td>1.73</td>
<td>10</td>
</tr>
<tr>
<td>Lack of information on the cost obtaining such service</td>
<td>2.72</td>
<td>1.74</td>
<td>11</td>
</tr>
<tr>
<td>Lack of appropriate education &amp; Training</td>
<td>2.21</td>
<td>1.68</td>
<td>12</td>
</tr>
<tr>
<td>Lack of managerial ability</td>
<td>2.09</td>
<td>1.59</td>
<td>13</td>
</tr>
</tbody>
</table>

The result in Table 4.3 suggest that of the 179 respondents one respondent did not get credit at all. Therefore, 21.91% i.e. 39 of the respondents received part of the credit they applied for and 78.09% i.e. 139 of the respondents obtained the full credit. It can be indicated that some of the SMEs did not receive the full credit they applied from the financial
institutions. This is imperative to this study as there is lack of studies that have determined the predictors that influence full credit accessibility and partial credit accessibility globally.

Table 4.3 Full or partial credit accessed

<table>
<thead>
<tr>
<th>Credit accessed</th>
<th>Respondents</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accessed partial credit</td>
<td>39</td>
<td>21.91%</td>
</tr>
<tr>
<td>Accessed full credit</td>
<td>139</td>
<td>78.09%</td>
</tr>
<tr>
<td>Total</td>
<td>178</td>
<td>100.00%</td>
</tr>
</tbody>
</table>

The results in Table 4.4 indicates that of the seven demographic and socio-economic independent variables modelled to predict full credit accessibility. Age group 40-49 years were likely to receive full credit than applicants who were in the age group 30 years and below. This finding suggests that financial institutions might deem applicants who are 30 years and young as being risky clients.

Table 4.4 Predictors of accessing full credit

<table>
<thead>
<tr>
<th>Variable</th>
<th>Exp. (B)</th>
<th>95% C.I. for EXP (B)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender (1)</td>
<td>2.102</td>
<td>0.929-4.757</td>
<td>0.075</td>
</tr>
<tr>
<td>Age group (1)</td>
<td>3538335.57</td>
<td>0.000 -纳</td>
<td>0.999</td>
</tr>
<tr>
<td>31-40 years (1)</td>
<td>1.000</td>
<td>0.000 -纳</td>
<td>1.000</td>
</tr>
<tr>
<td>40-49 years (2)</td>
<td>0.269</td>
<td>0.079-0.916</td>
<td>0.036</td>
</tr>
<tr>
<td>50 years and over (3)</td>
<td>0.668</td>
<td>0.215-2.074</td>
<td>0.485</td>
</tr>
<tr>
<td>Current position (1)</td>
<td>0.000</td>
<td>0.000 -纳</td>
<td>1.000</td>
</tr>
<tr>
<td>Owner (1)</td>
<td>0.000</td>
<td>0.000 -纳</td>
<td>1.000</td>
</tr>
<tr>
<td>Manager (2)</td>
<td>0.000</td>
<td>0.000 -纳</td>
<td>1.000</td>
</tr>
<tr>
<td>Manager/owner (3)</td>
<td>2.191</td>
<td>0.000 -纳</td>
<td>1.000</td>
</tr>
<tr>
<td>Ownership (1)</td>
<td>0.000</td>
<td>0.000 -纳</td>
<td>1.000</td>
</tr>
<tr>
<td>Partnership (1)</td>
<td>0.050</td>
<td>0.004-0.564</td>
<td>0.015</td>
</tr>
<tr>
<td>Limited partnership (2)</td>
<td>1.357</td>
<td>0.000 -纳</td>
<td>1.000</td>
</tr>
<tr>
<td>Limited Liability company (LLC) (3)</td>
<td>1.274</td>
<td>0.000 -纳</td>
<td>1.000</td>
</tr>
<tr>
<td>Tax number (1)</td>
<td>0.785</td>
<td>0.218-2.828</td>
<td>0.711</td>
</tr>
<tr>
<td>Location (municipality)</td>
<td>0.050</td>
<td>0.004-0.564</td>
<td>0.015</td>
</tr>
<tr>
<td>City of Tshwane Metropolitan Municipality (1)</td>
<td>0.246</td>
<td>0.063-0.958</td>
<td>0.043</td>
</tr>
<tr>
<td>Ekurhuleni Metropolitan Municipality (2)</td>
<td>0.707</td>
<td>0.175-2.863</td>
<td>0.627</td>
</tr>
<tr>
<td>West Rand District Municipality (3)</td>
<td>347074722804</td>
<td>6773200.000</td>
<td>0.999</td>
</tr>
</tbody>
</table>

Dependent variable: full credit accessibility (0=partial credit; 1=full credit) sig. at 5%
The results in Table 4.4 further indicate that the current position of the applicant predicted full credit accessibility. However, no category of current position in the organization stated indicated prediction of full credit accessibility. The results indicated the level of significance (p-value) were greater than 0.05 for all categories of current position in the organization. It was found that when the SMEs provided their tax number they had a greater chance of accessing full credit at 0.05, compared to those who do not provide their tax number. The level of significance was less than 0.05 at 0.015 hence a strong predictor. Furthermore, the SMEs whose premise were in Location, Ekurhuleni metropolitan municipality in Gauteng province had a higher probability of getting full credit, compared to SMEs in the city of Johannesburg metropolitan municipality. This predictor was significant at 0.043 which was less than 0.05. The odds of getting the full credit was 0.247 more those in city of Johannesburg. The gender of the respondent, and type of ownership did not predict full credit accessibility. Furthermore, it is imperative to mention that collateral was not statistically interpreted in the output result of SPSS despite being included in the analysis as a predictor.

However, prior to testing this model, the goodness of fit of the model was tested which indicated a good fit. This result was justified by the Hosmer and Lemeshow test. The significance of the model was greater than 0.05 at 0.271. The results suggest that the independent variables were fitting in the proposed theoretical model.

5. CONCLUSIONS AND RECOMMENDATIONS

The study found that SMEs are stifled from accessing credit because of lack of collateral/security, lack of cash flow statement and owners’ equity despite the results suggesting that majority of SMEs received the full credit they applied for compared to those who did not receive the full credit. However, this is still alarming as partial credit can hinder the progress of these organizations economically. It can be indicated that when SMEs receive part of the credit they might apply for credit in other financial institutions or request financial assistance from friends in order to cover for the deficit. This findings should be interpreted with caution as SMEs from Gauteng were the only respondents who participated. It is opined that the results might have been different if a country wide survey was undertaken within construction SMEs. Based on these findings, the researchers recommend that:

SMEs should provide, the age, and current position in the organization of the person applying for the credit. Furthermore, they should provide the tax number and the location of the business in order for them to obtain full credit from banks. It is worth indicating that SMEs should also be aware of the requirements that the financial institutions will request them to submit as they apply for credit.
6. REFERENCES


Dzadze, P., Osei Mensah, J., Aidoo, R. & Nurah, G. K., 2012, Factors determining access to formal credit in Ghana: A case study of smallholder farmers in the Abura-Asebu Kwamankese district of central region of


ABSTRACT

Purpose
This paper aims to analyse the results of a field study, conducted by the authors, to investigate the integration of Risk Management (RM) into the Architectural Design Process (ADP) as an approach for delivering sustainable construction projects.

Design/methodology/approach
To achieve this aim, a research methodology is designed to achieve three objectives. Firstly, reviewing literature related to ADP, sustainability and RM. Secondly, presenting three case studies to investigate the role of integrating RM into ADP towards delivering sustainable projects. Finally, analysing the results of a survey questionnaire conducted with a representative sample of Architectural Design Firms (ADFs) in Egypt to explore the applicability of integrating RM into ADP towards delivering sustainable projects.
Findings
Findings of the research showed that the construction industry is risky and complex business that is characterised with a number of unsustainable practices. In addition, RM is not well integrated into ADP which affects negatively the delivery of sustainable construction projects. Hence, developing a framework to integrate RM into ADP is a proposed solutions for delivering sustainable construction projects.

Research Limitations
The survey questionnaire targeted ADFs in Egypt only.

Practical Implications
This research is applicable through investigating the integration of RM into ADP towards delivering sustainable projects. This research helps improving the efficiency of the design process and consequently the construction industry.

Originality / Value
The originality of this research stems from the need to improve the performance of ADP towards delivering sustainable projects. In addition, it helps filling the gap of integrating RM into ADP as identified by literature review and the field study.

Keywords:
Risk Management, Architectural Design Process; Sustainable Construction Projects; Egypt.

1 INTRODUCTION
The Architectural Engineering profession is mainly concerned with delivering sustainable projects that translate the client’s requirements and end-user’s needs into technical design. The unsustainable practices of the construction industry in terms of resources and energy consumption and pollution and waste generation called for the construction industry to be sustainable and considering the environmental, social and economic impacts of the project on the surrounding environment (Chileshe, 2011; Rafindadi, et al., 2014). The construction industry is subject to more risk than any other industry. This is due to the complex and dynamic nature of construction projects and the involvement of multitude of participants and organisations with different objectives and skills which is considered a risk sources to projects. Failing to consider risk factors during early stages of the project life cycle affect the sustainability of the construction project. Although RM approach is applied in different phases of the project life cycle, its application in the design process encountered a scant attention in construction literature (Goral, 2007; Banaitis, 2012). Key risks that encounter projects during ADP have been identified by the authors and
presented at the Sustainable Mega Projects conference held in Egypt in 2016 (Abdelwahab and Othman, 2016). To complete the picture, this paper aims to analyse the results of a field study to investigate the integration of RM into ADP as an approach for delivering sustainable construction projects.

2 RESEARCH OBJECTIVES AND METHODOLOGY

To achieve the above mentioned aim, a research methodology based on literature review, case studies and survey questionnaire is designed to achieve three objectives. Firstly, literature review is used to investigate the topics of ADP, sustainability and RM. Secondly, case studies are used to investigate the role of integrating RM into ADP towards delivering sustainable projects. Finally, a survey questionnaire is conducted with a representative sample of ADFs in Egypt to explore the applicability of integrating RM into ADP towards delivering sustainable projects. Collected data is analysed quantitatively and qualitatively.

3 LITERATURE REVIEW

3.1 Architectural Design Process

As one of the key processes in the construction industry, the architectural design process plays an important role towards the project success. Throughout project lifecycle, the design process was meant to be a very critical process as the decisions taken during this process affect the performance of the project throughout its life cycle. These decisions include the people participating in the project, cost estimation, materials, systems and design features. Such decisions are critical that affect the project successful completion positively if well managed or negatively if ignored (Goral, 2007).

3.1.1 Project Lifecycle

Every project starts with an idea; this idea is developed through stages passing by decisions taken to improve its performance till it reaches the end or the close node of the project. A typical project life cycle consists of many phases. Each one has its own definition, scope of work and different participants. According to the Royal Institute of British Architects (RIBA) in their plan of work last update 2013, the typical project lifecycle is composed of eight main stages as follows:
Preparation and brief, concept design, developed design, technical design, construction, handover and closeout, in use and strategic definition (RIBA, 2013).

3.2 Sustainability

The world is in need for protecting the environment for the coming generations as a result, the sustainability concepts have evolved. The World Commission on Environment and Development defined sustainable development as the development that meets the needs of the present without compromising the ability of the future generations to meet their own needs (Maxwell, 2014). According to Stuart Maxwell, it is necessary to integrate sustainability concepts from the very beginning of any project as to ensure the successful delivery of sustainable projects. This evolution was a direct response to the gap between the concerns of environment and socio politics. Since then, the sustainable development terminology has been popular to lots of institutions all around the world. Variety of meanings has been spread among specialists about the term sustainable development and a greater confusion has evolved for sustainability concepts definition. Wider criticisms have been noticed for the actual implication of sustainability aspects. The basics of sustainability definition and its confictions have gradually become clear. Sustainability has three aspects as follows:

- The environmental aspect of sustainability focuses on using natural resources efficiently; reducing waste, pollution, effluent generation and emissions to the environment. In addition, it aims to reduce the negative impact on human health, encourage the use of renewable raw materials as well as eliminate toxic substances.

- A social sustainable society is one that is fair and accomplishes social justice when it comes to distributing its resources within itself. It is a society that would not discriminate in the rights of its individuals based on their ethnicity, sex, religion, age or social background (BenzuJK, 2011). These rights, which lead to a quality standard of living, include religious rights, right to housing, right to social security, right to work, freedom of speech, right to travel and right to own property.

- A society with a high population under the poverty line cannot achieve sustainability as this is accompanied by high unemployment rate, lack of education and low quality health care systems (Karlsson, 2009). An economically self-sustaining society is one that is able to use the available resources efficiently to provide its individuals with their needs without reaching out for help from neighbouring societies or countries.
3.3 Risk management

Due to the dynamic nature of construction projects, it involves different types of participants and organisations with different objectives and skills. Construction projects are subject to different types of risks that may affect its successful completion. These risks may cause project failure, clients’ dissatisfaction and cost overruns etc. According to Raftery (1994) Risk could be defined as “the exposure to the possibility of economic or financial loss or gain, physical danger or injury or delay as a consequence of the uncertainty associated with perusing a particular course of action”.

The RM consists of risk identification, risk analysis and risk response, see figure (5.1).

<p>| Table 6.1 Analysis of three case studies investigating the integration of RM into ADP |
|---------------------------------|---------------------------------|---------------|----------------|</p>
<table>
<thead>
<tr>
<th>Risk</th>
<th>Case Study</th>
<th>Count</th>
<th>Ignored</th>
<th>Effect on sustainability</th>
</tr>
</thead>
</table>

Figure 5.1 The Risk Management Process (Developed by the Authors)

4 Case Studies

Table (6.1) presents three case studies to investigate the integration of RM into ADP and its effects on the delivery of the sustainable projects (Goral, 2007; Cisco, 2006). Analysis of case studies clarified the risky and complex nature of the construction industry. Every case study encountered with specific risk at certain stage of the project life cycle. Risks at the ADP are critical due to their impact of the performance of the project throughout its life cycle. Projects’ successful delivery is highly dependent on the accuracy of the identified risk. The more precisely the risk is identified, the more the project is successfully delivered. The effect of the identified risks on the project successful delivery as well as on the sustainability aspects was examined.
5 Analysis of Field Study

A survey questionnaire was conducted to investigate the effect and applicability of integrating RM into ADP and its effect on the delivery of sustainable projects.

5.1 Response Rate

The research targeted ADFs in Cairo region, Egypt. The Egyptian Engineers Syndicate provided a list of registered 44 ADFs. Since the total population of the firms was small, all 44 firms were included in the survey sample. From the 44 firms, only 25 responded to the survey questionnaire, which represented a response rate of 57%. The data collected from the responses provided a valuable support for the research argument and findings.
5.2 Analysis of the survey questionnaire

88% of the respondents stated that they are aware and perceive the concept of sustainability and underlying principles. However, these firms mentioned that due to a number of reasons this concept is not applied during the design process. These reasons included:

- Lack of successful examples on how to apply sustainability in design (63.64%)
- Culture of the Egyptian construction industry (59.09%), nature of projects (9.09%)
- Lack of resources (27.27%)
- Poor economy (50%)

Statistics indicate the lack of the practical application and availability of successful local examples is the main cause for not applying sustainability in ADFs. This raises an important issue concerning the gap between the theoretical and applicable sides of sustainability. In addition, a new reason was added by respondents that integrating sustainability principles in design is not a mandatory requirement by clients or government.

Concerning the influence of integrating RM into ADP to deliver sustainable projects, respondents were asked to rate the influence on a scale of 1-5, where 5 is the most influential and 1 is the least.

- 4% of respondents rated the influence by (5/5).
- 40% of respondents rated the influence by (4/5).
- 52% of respondents rated the influence by (3/5).
- 4% of respondents rated the influence by (2/5).

Responses indicate that most respondents believe that it is quite necessary to integrate RM into design to deliver sustainable projects. The mean value was calculated to be 3.44 leading to the calculation of the mode and the median to be equal 3. Figures (8.2 & 8.3) present the Relative Importance Index (RII) of the list of risks identified that encounter the ADP showing their severity and probability.
5.3 Risk probability analysis

Respondents were asked to rank the identified risks according to their probability of occurrence. Table (9.2) explains the probability of risk occurrence using the measure of central tendency (mean, median, and mode) and measure of dispersion (SD and V) as well as RII of each risk.
### Table 9.2 Analysis of risk probability of occurrence

<table>
<thead>
<tr>
<th>Code (1)</th>
<th>Risks (2)</th>
<th>Measure of central tendency</th>
<th>Measure of dispersion</th>
<th>Percentage of respondents scoring</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Mean (3)</td>
<td>Median (4)</td>
<td>Mode (5)</td>
</tr>
<tr>
<td>KR1</td>
<td>Design cost overruns</td>
<td>4.20</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>KR2</td>
<td>Variations by client</td>
<td>3.76</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>KR3</td>
<td>Design variations</td>
<td>3.78</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>KR4</td>
<td>Lack of coordination between project participants</td>
<td>3.72</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>KR5</td>
<td>Unavailability of sufficient professionals and managers</td>
<td>3.68</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>KR6</td>
<td>Design errors and omission</td>
<td>3.64</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>KR7</td>
<td>Design process takes longer than needed</td>
<td>3.64</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>KR8</td>
<td>Tight project design schedule</td>
<td>3.64</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>KR9</td>
<td>Failure to carry out the work in accordance with contract</td>
<td>3.60</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>KR10</td>
<td>Stakeholders request rate changes</td>
<td>3.47</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>KR11</td>
<td>Environmental analysis in complete</td>
<td>3.40</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>KR12</td>
<td>Incomplete approval and other documents</td>
<td>3.36</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>KR13</td>
<td>New alternatives required to avoid, mitigate or minimize environmental impact</td>
<td>3.32</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>KR14</td>
<td>Contradiction in construction documents</td>
<td>3.32</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>KR15</td>
<td>Technology changes</td>
<td>3.28</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>KR16</td>
<td>Resources availability</td>
<td>3.04</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>KR17</td>
<td>Public objections</td>
<td>2.88</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>KR18</td>
<td>Laws and local standards</td>
<td>2.92</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>

### 5.4 Risk severity analysis

Respondents were asked to rank the identified risks according to their severity. Table (10.3) explains the severity of risks using the measure of central tendency (mean, median, and mode) and measure of dispersion (SD and V) as well as RII of each risk.
5.5 Risk analysis matrix

Table (10.4) shows the calculation of each risk including its probability and severity. Risks lie in the very high and high category. Results showed that the risks that have the highest influence in the ADP and affect the delivery of sustainable projects are: design cost overruns, unavailability of sufficient professional and lack of coordination between project participants, variations by the client and design variations.

Table 10.4 Analysis of risk severity

<table>
<thead>
<tr>
<th>Code (1)</th>
<th>Risk (2)</th>
<th>Measure of central tendency</th>
<th>Measure of dispersion</th>
<th>Percentage of respondents scoring</th>
<th>Risk (3)</th>
<th>RRI (4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>KR1</td>
<td>Design cost overruns</td>
<td>3.80 4 4.07 2.96</td>
<td>3.3% 58.6% 39%</td>
<td>0.83</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>KR2</td>
<td>Unavailability of sufficient professionals and managers</td>
<td>3.24 3 3.04 1.15 4% 58% 30%</td>
<td>0.79</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>KR3</td>
<td>Lack of coordination between project participants</td>
<td>3.56 4 4.05 1.74 5% 90% 10%</td>
<td>0.78</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>KR4</td>
<td>Inadequate design and omission</td>
<td>3.38 4 4 0.73 3.17 12% 88% 20%</td>
<td>0.76</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>KR5</td>
<td>Environmental analysis in incomplete</td>
<td>3.64 4 4 0.13 0.24 8% 88% 24%</td>
<td>0.74</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>KR6</td>
<td>Site stability requests late changes</td>
<td>3.44 3 3 0.04 0.59 12% 72% 16%</td>
<td>0.61</td>
<td>7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>KR7</td>
<td>Incomplete approval and other documents</td>
<td>0.48 4 0 0.04 0.51 5% 64% 8%</td>
<td>0.58</td>
<td>9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>KR8</td>
<td>Design variations</td>
<td>0.86 4 4 0.19 0.36 8% 70% 4%</td>
<td>0.80</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>KR9</td>
<td>Variations by client</td>
<td>0.98 4 4 0.19 2.26 8% 88% 3%</td>
<td>0.98</td>
<td>9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>KR10</td>
<td>Failure to carry out the work in accordance with contract</td>
<td>0.80 3 3 0.00 0.05 24% 76% 12%</td>
<td>0.81</td>
<td>10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>KR11</td>
<td>Contradiction in construction documents</td>
<td>0.00 3 3 0.01 0.10 24% 76% 16%</td>
<td>0.81</td>
<td>10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>KR12</td>
<td>Design process takes longer than needed</td>
<td>0.73 4 4 0.06 0.23 24% 76% 12%</td>
<td>0.81</td>
<td>10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>KR13</td>
<td>Risk alternatives required to avoid, mitigate or minimize environmental impact</td>
<td>0.24 3 3 0.04 0.10 12% 88% 4%</td>
<td>0.80</td>
<td>11</td>
<td></td>
<td></td>
</tr>
<tr>
<td>KR14</td>
<td>Technology changes</td>
<td>0.38 3 3 0.03 0.17 28% 72% 0%</td>
<td>0.84</td>
<td>12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>KR15</td>
<td>Laws and local standards</td>
<td>0.18 4 4 0.11 0.30 12% 88% 3%</td>
<td>0.60</td>
<td>13</td>
<td></td>
<td></td>
</tr>
<tr>
<td>KR16</td>
<td>Public opposition</td>
<td>0.20 3 4 0.02 0.16 24% 76% 0%</td>
<td>0.60</td>
<td>13</td>
<td></td>
<td></td>
</tr>
<tr>
<td>KR17</td>
<td>Public opposition</td>
<td>0.00 3 4 0.01 0.10 50% 50% 0%</td>
<td>0.58</td>
<td>14</td>
<td></td>
<td></td>
</tr>
<tr>
<td>KR18</td>
<td>Technology changes</td>
<td>0.38 3 3 0.03 0.17 28% 72% 0%</td>
<td>0.84</td>
<td>12</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

5  Conclusion and recommendations

Having reviewed literature review and keeping in mind the analysis of case studies and the survey questionnaire, the research comes to the following conclusions and recommendations. Although the surveyed ADFs have
sufficient knowledge about sustainability, a number of reasons obstruct its application during ADP. These reasons included: lack of successful examples on how to apply sustainability in design, culture of the Egyptian construction industry, nature of projects, lack of resources and poor economy. Lack of considering risk factors during the design process affects the delivery of sustainable projects. Design cost overruns, unavailability of sufficient professional and managers and lack of coordination between project participants are the risks that carry the highest severity of project’s successful delivery. This research provided a critical contribution to a topic which has suffered from a scant attention in construction literature. It provides facilities for the improvement of ADP. It further builds a very strong background for the design process, sustainability and risk management which are the pillars on which the aim of this research stands. The research recommends developing a framework to integrate RM into the ADP to deliver sustainable construction projects. In addition, providing ADFs with practical examples to explain the practical side of integrating RM and sustainability in construction projects. Furthermore, government authorities are required to set legislation to enforce the application of sustainability and RM as a requirement for issuing building license.

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A field study investigating the role of post occupancy evaluation in improving the performance of architectural design firms in Egypt

Ayman A. E. Othman¹ and Heba A. I. El Saay²
Architectural Engineering Department
Faculty of Engineering
The British University in Egypt (BUE)
El Shorouk City - Cairo Suez Desert Road
Postal No. 11837 - P.O. Box 43
Tel.: (+202) 26890000
E-mail¹: ayman.othman@bue.edu.eg
E-mail²: Heba_elsaay@icloud.com
Orcid.org/0000-0001-9842-3885
Orcid.org/0000-0003-2465-1724

ABSTRACT

Purpose
This paper aims to analyse the results of a field study, conducted by the authors, to investigate the role of Post Occupancy Evaluation (POE) as a learning tool for improving the performance of Architectural Design Firms (ADFs) in Egypt.

Design/methodology/approach
To achieve this aim, a research methodology is designed to achieve three objectives. Firstly, reviewing literature related to POE, learning organization and performance management. Secondly, presenting and analysing four case studies to investigate how organizations improved their performance through applying POE. Finally, analysing the results of a survey questionnaire conducted with a representative sample of ADFs in Egypt to investigate their perception and application of POE as a learning tool for improving their performance.
Findings
The lack of learning culture through POE within ADFs affects negatively their performance. Therefore, emphasis on learning through POE is a cornerstone for sustaining business performance of ADFs.

Research Limitations
The survey questionnaire targeted ADFs in Egypt only.

Practical Implications
Incorporating POE as a learning tool will help ADFs sustain their competitiveness and enhance their performance.

Originality / Value
This research is a first step towards promoting interdisciplinary thought and understating the role of POE in creating a learning environment that improve the performance of ADFs.

Keywords: Post-occupancy evaluation, learning organization, Architecture design firms, organizational performance.

1 Introduction
The construction industry plays a significant role towards supporting governments achieving their sustainable development objectives. This could be attained through constructing projects and infrastructure facilities that provide societies with their needs and fulfill their requirements (Othman, 2013). People spend most of their time inside buildings and in the surrounding environment practicing their activities (Davis, 1986). With the increasing expectations of clients coupled with technology advancement and changes in the business environment, clients and organizations increased their potential for buildings to support their businesses, improve employees' productivity, increase accessibility, reduce energy consumption and facilitate maintenance. End-users expect buildings to be functional, comfortable, and not to affect their health in a negative way (Council, 2001). This highlights the role of ADFs as the first line of contacts with clients in the construction industry and the entities responsible for transforming clients' requirements into final product. The current status of ADFs showed lack of client participation in the design process, design delays, poor quality, repeated omissions and errors, lack of information flow, poor feedback and learned lessons which ultimately lead to losing competitive advantages and business failure. Although these shortcomings could be attributed to a number of reasons, one of the most pressing one is the lack of learning from previous experience and feedback. ADFs rarely engage closely with their finished projects and disconnect completely from them (Way and Bordass, 2005) thus, missing the chance of any improvement in their performance (Gabr, 2005). One of the highly
successful tools in measuring building performance is POE, where it provides a learning platform through feedback that can be used by the whole organization to improve its performance, thus improving its output of newly designed buildings. This paper aims to analyse the results of a field study, conducted by the authors, to investigate the role of POE as a learning tool for improving the performance of ADFs in Egypt. To achieve this aim, three objectives have to be accomplished. Firstly, reviewing literature related to POE, learning organization and performance management. Secondly, presenting and analysing four case studies to investigate how organizations improved their performance through applying POE. Finally, analysing the results of a survey questionnaire conducted with a representative sample of ADFs in Egypt to investigate their perception and application of POE as a learning tool for improving the performance of ADFs.

2 Literature Review

2.1 Building Performance

A Building Performance is a measurement of the efficiency and effectiveness of a building to achieve its intended function and satisfy the needs and expectations of its users (Davis, 1986). The degrees of acceptance of a building performance vary based on physiological, social and economic values of individuals. Based on the desired performance, a demand on the building components is present to satisfy them (Davis, 1986). Building performance shall meet three main terms: sustainability, reliability and flexibility.

- **Sustainability**: is a measurement of the degree at which a building can serve its occupants during the present time and near future.
- **Reliability**: is a measurement of the degree at which a building will continue to serve its occupants while maintaining its sustainability measures.
- **Flexibility**: is a measurement of the degree at which the building will provide long term sustainability throughout its usage (Davis, 1986).

2.2 The Concept of Learning Organization

A learning organization is one that considers learning as a continuous process of improvement which is fundamental to business success (Armstrong, 1998). Learning organizations are more proficient at problem solving, developing creative ideas, learning from their experiences and transferring new ideas into practice. To improve their performance,
organizations has to focus on continuous learning and use of knowledge, which can serve as a critical key to success for facilitating individual, team, and organizational learning leading to continuous improvement and innovation in business operations (Alipour, 2011). For organizations to achieve these ends, they need to have the qualities of learning organization which helps facilitate the learning of all its members and consciously modifies itself and affects its context (Pedler, 1996). Additionally, learning organizations comprise embedded systems to capture and share knowledge so that the organization may continue to progress and develop competitively (Sarkis, 2010).

2.3 Organizational Performance

Organizational performance is a multidimensional concept where it defines the organization success and it is a way of indicating the level of achieving the objectives of the organization in an effective and efficient manner. In management, organizational performance can be defined as the accomplishment of organizational goals in an effective and efficient manner (Civelek, et al., 2015).

2.4 Post Occupancy Evaluation

POE is the process conducted once the building is occupied to assess its performance. The process believes in the importance of getting a feedback from building occupants to get an understanding of users’ needs through a systematic process (Council, 2001). It is the assessment of building performance at a given environment, with the aim in providing realistic information and comparing it to the theoretical data available (De Wilde, 2014). POE is not only considered as a tool for measuring the building performance, however, it is valued as a process which explains, and aids in improving organizational performance.

2.5 The Relationship between POE, learning organization and Organization performance

The deterioration of buildings receives a low response from ADFs in Egypt, most of these organizations show low interest in capturing or in reflecting on their lessons learned from earlier projects (Love, 2004) They focus mainly towards detecting errors and correcting them, rather than preventing them (Gabr, 2005). Therefore, chronic problems and low performance tend to continue. In order to shift the focus towards a prevention attitude, construction organizations need to develop a learning culture where knowledge and learning are to be considered fundamental factors for improving their performance (Love, 2004) by improving the performance of
the built environment. This highlights the importance of establishing a feedback loop to enhance their performance. POE was analysed as a proposed tool that facilitates the acquisition, sharing and saving of knowledge within the organization as illustrated in figure (5.1).

Figure 5.1 Relationship between POE, learning organization and Organization performance (Developed by Author)

2.6 The Absence of a learning environment in ADFs

As the Construction industry is characterized by its fragmented nature as a whole, and in particular the design process where many phases takes place, Capturing knowledge and sharing information within an organization is found to be relatively hard leading to the loss of the most valuable information available along the way (Othman and Halim, 2015). Although continuous learning is important to sustain competitiveness, construction organizations are being criticized of being unable to apply learning and use it for improvement (Hartmann and Dorée, 2015).

2.7 POE as a learning tool within the organization

One objective of this paper is to review through previous literature the possible relationship between POE and learning organization, and its effectiveness as a tool for learning within the organization. It is been argued by (Council, 2001) that in order to optimize the value gained from the conduction of POEs, it is required to initiate the willingness to collect data, provide time to analyses it and the determination to share it. In order for this to happen, a commitment is required from senior management to support a long-term ideology for implementing POE. Moreover, a need for creating a broad opportunities for participation and reflection between different stakeholders are needed. POE can be used as a tool for learning
within an organization if it was linked with "key business drivers" of this organization. In addition to this it suggests that POE has a great potential in providing lessons learned system for analysis (Council, 2001).

3. Case Studies

3.1 Overview of the case studies

The case studies discuss the adaptation of learning within an organization, such as learning from feedback (POE) as well as other techniques used. Four, UK based organizations are analysed, namely Feilden Clegg Bradley Architects (FCBA), Arup, Buro Happold and Atkins. The different tools adopted by each organization and their impact on the organization performance are presented in Table (6.1). The case studies cover a variety of project types. The investigated organizations were familiar with feedback and POE in some form.

3.2 Review of the used Techniques in the Case Studies

The case studies supported different techniques to reflect feedback within different stages of the project. Each selected the best suited technique based on their expertise, project stage and work in hand. The following was found:

- Obtaining feedback through survey questionnaire was commonly used. Surveys were well-established, clear, easily filled that is why a high response rate was achieved.
- Costs associated with adopting POE have dropped considerably by time as the analysis became more automated.
- Survey questionnaires were able to provide a comprehensive review of buildings without the need for a site visit.
- Teams conducted energy measurements not only to reduce costs, but, also reflects the design, build quality, maintenance, management and user behavior.
- The enhanced communication between different project players came as an undeniable success contradicting the usual perception of how difficult and costly it is to gather people. All participants highlighted how valuable these meetings are, aiming at making it more common as everyone gets used to its concept.
- For feedback to be implemented as a routine, a change in process is vital.
- It is more challenging to apply these modifications to an ongoing project as the project team is already assigned to the conventional work plans.
Combining both energy assessments and occupants feedback is more useful as it correlated the "soft" issues such as users perception, management and culture as well as "hard" issue such as technical and environmental aspects.

Table 6.1 Review of Tools used in Case Studies and their impact on Learning and Organization Performance (Developed by Authors)

<table>
<thead>
<tr>
<th>Company Name</th>
<th>Learning Initiatives</th>
<th>Learning Improvement</th>
<th>Performance Improvement</th>
</tr>
</thead>
</table>
| Feilden Clegg Bradley Architects (FCBA) | • Hindsight Review: Technique used to promote sharing learned lessons between members of the organization.  
• Yellow Pages: Skills data based developed to connect resources and skills in a friendly and smooth manner.  
• Wills How Knowledge Base: Knowledge base to share knowledge and facilitate easy access to needed information.  
• POE:                                             | Improved Organizational learning                                                      | • Acknowledge as one of the top pioneers in sustainable design and innovative architectural solutions.  
• Won a great number of awards from different authorities.  
• Grown in its projects size from 10 million GBP to over 70 Million GBP.  
• Increasing the organization partners number to over the double in only four years. |
| Arup                          | • Feedback techniques (POE & Other tools)                                            | • Improved Organizational learning        | • Commissioning iconic projects such as Singapore Sport's Hub and Beijing's Water Cube.  
• Established an intranet for sharing technical resources.  
• Commitment to Research.  
• Developing Arup Appraise (POE Service)                                      | • Improved Competitiveness of the organization within the industry.  
• Increased the client trust and projects innovation                          |
| Buro Happold                  | • Commitment to Research Feedback (POE & Other tools)                                | • Improved Organizational learning        | • Attaining the organization objectives.  
• Responding positively to the economic, environment and social aspects.  
• Enhancing the current building performance as well as benchmarking skills.  
• Commitment to Research Feedback (POE & Other tools)                           | • Increased number of Company partners across 23 Locations. |
|                              | • Commitment to Research Feedback (POE & Other tools)                                |                                           |                                           |
|                              | • Improved Organizational learning, comprehensive understanding of the building performance as well as benchmarking skills. |                                           |                                           |
3.3 Case Studies Discussion

The case studies emphasized the value of feedback and the importance of mixing techniques to increase the potential of the added value to projects, stakeholders and users. They highlight the fact that major ADFs, large and small, are involved in conducting feedback and a mounting interest in enhancing and applying it is observed. Feedback is acknowledged as a key factor in improving the quality of the built environment as well as the organization performance. Adopting feedback as a routine procedure is still rare and regarded as a research and development effort by many organizations; although leading organization has an increasing interest in conducting feedback more routinely, making sure it will be systematic and cost effective (Bordass and Leaman, 2005). Adopting the survey techniques appeared to be easier than arranging workshops. Yet, the cost of a well-established survey came as a challenge which delayed or stopped some of these case studies.

3.4 The Value of feedback

The analysis of case studies acknowledged the different positive impact of adopting of feedback on clients, designers, users and environment. The direct positive impact can be observed in briefing, design and managements of current and future projects. For maximizing the value of feedback and starting to implement it as a routine stage in building
procurement projects, costs challenges needs to be tackled as well as standardizing the process. The case studies highlighted the great added value from getting feedback from occupants, although designers think they are users, their perspective is found to be different than building users. Leading designer highlighted the value of feedback from previous projects and its added value during the briefing phase in the project. Moreover, a building performance could be enhanced right after occupancy if feedback was performed, also making it possible for designers to learn from experience, as well as share these lessons with others.

3.5 Key Challenges for implementing POE

Firstly, cultural change is required to change the perception of clients and industry members towards the value of feedback and follow through, and that applying it should not be an option, but a vital step towards achieving better added value process (Bordass and Leaman, 2005). Secondly, change in process is required to facilitate the introduction of feedback and its adaptation and attach it to the conventional procedures (Usablebuildings, 2016). Thirdly, techniques development is required to establish a foundation for assessment and benchmarking. Fourthly, tackling financial limitation and assigning a decent value to conduct it. Finally, capturing and saving collected data is vital to get the benefit from applying feedback.

3.6 Case studies Collective Conclusion

Analysing four case studies encouraged a positive understanding of the utility of adopting the feedback technique for learning as well as it added value within the building procurement process. Participants considered it to be as a key for competence which impacts positively their organization development. Using feedback techniques comes as a quick and efficient solution where people can reflect on their previous projects in an easy, inexpensive way. Furthermore, more organizations are looking into adopting spreading feedback and other lessons learned from previous project into their whole organization to maximize the benefit. In order for this to be applied, organization will need to be exposed to the feedback process to be able to assess the actual benefits from using it and then be convinced of its applicability. A great pressure is now put on the shoulders of architects and builders in order to know what needs to be done and how it can be delivered so that users become more engaged. Finally, throughout the case studies, the project teams and other stallholders observed the benefit of applying feedback and POE studies on improving the overall performance of the built environment, promoting innovative solutions and motivating learning.
4. **Research Methodology**

Since there is no quantification without qualification and no statistical analysis without interpretation, during the course of this research, approaches of both quantitative and qualitative data analysis are employed.

4.1 **Analysing Quantitative Data**

Quantitative data collected from the survey questionnaire was analysed using two approaches. Firstly, the measure of central tendency is used to get an overview of the typical values for each variable through computing the mean, median and mode. Secondly, the measure of dispersion is used to investigate the homogenous or heterogeneous nature of the collected data by calculating the Variance ($V$) and the Standard Deviation ($SD$). Analysis of the collected data revealed close values of these measures which confirmed its quality and homogeneity.

4.2 **Analysing Qualitative Data**

Qualitative analysis is used in Analysing the data collected from the literature review and the open-ended questions in the survey questionnaire. The data was analysed by ensuring firstly that only data relevant to the research was analysed, followed by categorizing similar responses and lastly summarizing and presenting the responses.

4.3 **Response Rate**

The research targeted ADFs in Cairo region, Egypt. The Egyptian Engineers Syndicate provided a list of registered 44 ADFs. Since the total population of the firms was small, all 44 firms were included in the survey sample. From the 44 ADFs that were selected, 38 firms responded to the survey questionnaire, which represents a response rate of 86.38% that supports the research findings and recommendations.

4.4 **Discussion of Results**

4.4.1 **Post occupancy Evaluation (POE)**

Analysis of results showed that 63% of respondents showed understanding of the concept of POE which reflects the maturity of the surveyed ADFs and their capabilities. In addition, out of 34.2% of ADFs that conducted POE, 53.8% of them conduct POE between 1-2 years from occupancy as
the building is new and its components are in operation which helps measuring its performance. In addition, respondents stated that site visit is the most commonly method used for conducting POE where paper circulated survey was the least ranked method. 65.8% of ADFs that do not conduct POE stated that the most ranked causes were lack of team awareness due to lack of education and training. In addition, they mentioned that low priority given to research and development related to POE as a learning tool for improving performance of ADFs obstructed the application of POE. Furthermore, lack of systems in ADFs to conduct POE and lack of management commitment are other reasons for not conducting POE.

4.4.2 Learning Organization

Analysis of results showed that 73.7% of respondents mentioned that they apply learning organization concept. In addition, 78.9% of respondents showed good to very good perception of the concept of learning organization. This reflects that ADFS consider learning as an important issue of improving their performance. Moreover, 65.80% of the respondents have high adherence to seeking and generating new methods of working for performance improvement. 57.9% of the respondents showed high adherence to identifying and overcoming problems caused by previous mistakes or unsatisfactory performance. Furthermore, 71.1% of respondents highlighted the support of Senior Management and rewarding proposals as a tool for establishing learning environment in ADFs. 57.9% of the respondents stated the importance of establishing internal communication between senior and junior staff as a tool for establishing learning environment in ADFs. Training and team meetings were the most used methods of learning by 75% and 67.9% respectively.

4.4.3 POE and Learning

The research hypothesis namely, POE a learning tool that will enhance the performance of architectural design firms in Egypt, was tested in this section where 44.7% of the respondents highly agreed that POE could be used as tool to facilitate learning from feedback from previous projects with an average of Very Good (4/5) and 39.5% strongly agreed with an average of (5/5). 63.2% of respondents agreed that their organizations are willing to engage in activities that impact positively on the organizational learning culture. These activities include (1) attending conferences and workshops, (2) sharing knowledge with other colleagues, (3) rotation of employees between departments, (4) enhancing the competitiveness in the market place along with its reputation and (5) developing framework to facilitate the integration of POE as a learning tool for improving organizational
performance. 84.2% of respondents showed their interest in studying more information about POE as an approach for improving the performance of ADFs.

6. Conclusion and recommendation

Although building performance metrics are being developed, a gap between the designed and expected performance is still identified. ADFs tend to disconnect from their finished projects, missing any opportunity for learning from feedback to prevent repetitive poor performance of building, thus affecting negatively on their performance. In Egypt, poor building performance continues as a chronic problem that is neglected. This stresses on the importance of investigating the role of ADFs towards such problem. The research paper investigated the role of learning through feedback on enhancing ADFs performance as well as the built environment. The research paper contributes to the original body of knowledge, as based on the increasing emphasize on learning and knowledge creation and its added value to organizational performance. The paper provides an innovative approach in utilizing POE as a learning tool to improve the performance of ADFs. Thus, reflecting positively on the built environment performance. The case studies emphasized the value of feedback, highlighting Feedback as a key factor in improving the quality of the built environment as well as the organization performance. Moreover, Data collected from survey questionnaire highlighted the willingness of ADFs in Egypt to adopt learning through POE to enhance their performance.

The following recommendations could be made:

- ADFs need to consider organizing awareness campaigns and strategies to raise the understanding of POE, its uses, potential benefits and methods to conduct it.
- ADFs need to adopt training policy to train their employees to adopt POE.
- ADFs need to make sure a full upper management support and utilization of resources to achieve the desired goal.
- Learning is a continuous improvement process that requires long-term commitment and dedication.
- The organization culture, values and strategies need to facilitate and motivate the implementation of POE and learning to improve performance.
- An ongoing process of trial and error should be adopted to reach "best-in-class" approach that is convenient to the organization.
- The effective implementation require a collaborative involvement form all organizational levels.
References


ABSTRACT AND KEYWORDS

Purpose: Ethical leadership and decision making affects the behaviour and performance of individual employees. Apart from possessing personal traits such as honesty, integrity and trustworthiness, ethical leaders are characterized by a set of behaviours that include setting and communicating high performance expectations, appropriate role-modelling behaviours such as self-discipline and responsibility and good for the collective such as speaking up about issues of concern, using rewards to hold people responsible for appropriate conduct, and treating people fairly and with respect. This study seeks to determine the pervasiveness of these traits in the South African construction sector and their impact on decision-making.

Design/methodology/approach: A convenience sample of contractors in Durban was surveyed using a quantitative questionnaire survey instrument developed from published literature on ethics, ethical leadership and ethical decision making.

Research limitations: The sample of 60 contractors was drawn only from the KZN region which is the focus of this study.

Findings: Preliminary findings suggest that the standard for right and wrong is fuzzy with consequences on behaviour which is ethical.
Response to conference theme: This study identifies the lack of ethics, standards, leadership and decision-making in the South African construction industry.

Practical implications: The findings provide insight into a highly sensitive and controversial aspect of doing business in South Africa which if addressed appropriately will improve the business environment.

Keywords: ethics, ethical leadership, ethical decision-making, construction, contractors

Conference sub-theme: Construction Education

1. INTRODUCTION

The question of ethics in South African politics has become a burning public issue as a result of many reported cases of corruption and exercise of patronage in order to secure contracts, or to deviate from legal rules, and the Constitution itself. Ethics is broadly defined as the study of moral value of human conduct and of the rules and principles that ought to govern the social, religious or civil code of behaviour of a particular group, profession or individual (Tagoe, 2006). Likewise, the Oxford English Dictionary defines Ethics as “relating to morals, treating of moral questions” (Sykes, 1987).

In the field of Engineering and the Built Environment, recent attention has been placed on how construction personnel have perceived, articulated and resolved ethical dilemmas in the routine practice of the built environment (Sindelar, et al, 2003). Unfortunately, very little literature presents itself on the awareness of integrating ethics within the built environment and how the knowledge of ethical principles translate into professional best practice in this environment (Sinha et al, 2007).

The effects of unethical activities are disastrous and result in far-reaching consequences for both individuals and collective groups at large. According to Sebola (2014) culture is a major factor that may influence unethical practice. The factors of key discussion in this study will include issues of, Ethics, Ethical Leadership, Ethical Lapses, and/ or Consequences/impacts of these on performance within the construction industry.

2. ETHICAL LEADERSHIP

Ethical leadership is a concept iterated by Walumba et al., (2012) who discussed the marked divergence of leadership as a normative ideology, namely how leaders ought to behave versus how leaders actually do behave within group work environments. In the construction industry, the
issue of leadership is one that highly influences group ethical behaviour. Managers and supervisors appear to become the yardsticks of ethical behaviour in their respective spheres of influence. According to Samat, et al., (2016) both the internal locus of control and the external locus of control should feature when addressing ethical behaviour. Ethical behaviour can, therefore, typically be divided into personal and peer/supervisor influences.

3. THREAT OF UNETHICAL AND CORRUPT ACTIVITIES

Unethical and corrupt activities become a “threat to democracy,” (Sebola, 2014) and in a society that strives for democracy and fairness in all activities, this threat robs people of their basic human rights. Lapses in ethical behaviour can result in far reaching, often dangerous consequences as stated by Bowen et al in their discussion on corruption in the South African Construction Industry, the authors display verbatim commentary by participants. Here it is noted that detection resources are scarce, and highly relevant is the fact that “whistle-blowers” are vulnerable and poorly protected.

In a ground-breaking but disturbing example at Penn State University in the United States of America, the issue of lapses in ethical ideology was strongly highlighted by Arlen & Langvardt, (2012). The issue of a coach encroaching onto a student’s private and sexual space became a case for discussion of the far-reaching effects when ethics are ignored. In this regard, ethics is seen as a sociological concept and is not simply confined to an industry such as construction. This highlights the argument that, as Samat, (2016) identify as well, ethics is about fundamentally human beings knowing what is morally right and what is wrong. The most negative effect of lapse in ethics in the Penn State case was that the solid record and years of good service of someone at an institution was broken in one ethical lapse.

Sebola (2014) discusses an example where a former MEC for Transport in KwaZulu Natal was given gifts of a Mercedes Benz and cattle, by a group of contractors who benefitted with securing tenders and contracts during his tenure. This case was widely publicised in South Africa and seemed to polarise opinions about this large issue facing all industries in this fledgling economy.

4. RESEARCH APPROACH

A convenience sample was surveyed comprising of 60 industry practitioners about their views and experiences of ethics, ethical leadership and ethical decision making. The data was collected via a quantitative questionnaire survey comprising of a section containing 18 attributes of leadership, a section containing 19 activities, a definition of ethical
leadership, a section of 20 factors or influences on behaviour, values and attitudes, a section of 10 statements on ethical lapses, and a section on unethical activities. In most cases respondents were required to give a scaled response of frequency or agreement. Descriptive statistics were derived using SPSS v23 and presented including measures of central tendency and dispersion. The internal validity of scaled responses was determined by the Cronbach’s alpha co-efficient for validity.

5. RESEARCH FINDINGS

Profile of respondents

Respondents had worked in the construction industry for a median five years with a minimum period of one year and a maximum period of 30 years. Respondents were involved in construction in the following capacities, namely:

- Built environment professionals such as quantity surveyors and project managers – 31.6%
- Senior and middle management – 22.8%
- Site employment – 26.3%
- Contractors/sub-contractors – 19.3%

Reliability

Table 1 shows the Cronbach’s alpha co-efficient for the scaled responses that make up each of the sections of the survey instrument. There is an acceptable degree of internal consistency for the scales used for all the constructs, namely a Cronbach Alpha statistic which is greater than the rule-of-thumb 0.700 for acceptable internal scale consistency. There is therefore between 90.4% and 98.7% probability that the constructs each measure a single underlying concept with an error of at most 5%. The scales used are therefore acceptable in their measure of the reliability of the constructs.

Table 1. Reliability co-efficients (n=60)

<table>
<thead>
<tr>
<th>Construct</th>
<th>Reliability co-efficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethical leadership attributes</td>
<td>0.987</td>
</tr>
<tr>
<td>Questionable activities</td>
<td>0.985</td>
</tr>
<tr>
<td>Factors/influences on ethical behaviour, values and attitudes</td>
<td>0.963</td>
</tr>
<tr>
<td>Ethical lapses</td>
<td>0.904</td>
</tr>
</tbody>
</table>
Ethical leadership

Most respondents tended to agree (mean=4.05) that ethical leadership was the demonstration of normatively appropriate conduct through personal actions and interpersonal relationships, and the promotion of such conduct to followers through two-way communication, reinforcement and decision-making. Respondents indicated that they had only sometimes (mean=3.25) evidenced (seen or experienced) this kind of ethical leadership in their engagement with the construction industry.

Ethical leadership attributes

Respondents were requested to indicate the frequency with which they observed or experienced several leadership attributes in the leadership they had encountered or worked with during their careers in construction using a 5-point scale where 1=never, 2=seldom, 3=sometimes, 4=often and 5=always. Their responses are shown in Table 2.

Table 2. Ethical leadership attributes (n=60)

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Mean</th>
<th>SD</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hard-working</td>
<td>3.77</td>
<td>1.29</td>
<td>1</td>
</tr>
<tr>
<td>Responsibility</td>
<td>3.60</td>
<td>1.30</td>
<td>2</td>
</tr>
<tr>
<td>Achievement-oriented</td>
<td>3.57</td>
<td>1.26</td>
<td>3</td>
</tr>
<tr>
<td>Carefulness</td>
<td>3.52</td>
<td>1.29</td>
<td>4</td>
</tr>
<tr>
<td>Trustworthiness</td>
<td>3.49</td>
<td>1.25</td>
<td>5</td>
</tr>
<tr>
<td>Reliability</td>
<td>3.49</td>
<td>1.29</td>
<td>6</td>
</tr>
<tr>
<td>Diligence</td>
<td>3.49</td>
<td>1.32</td>
<td>7</td>
</tr>
<tr>
<td>Organized</td>
<td>3.48</td>
<td>1.20</td>
<td>8</td>
</tr>
<tr>
<td>Perseverance</td>
<td>3.48</td>
<td>1.22</td>
<td>9</td>
</tr>
<tr>
<td>Efficient</td>
<td>3.48</td>
<td>1.30</td>
<td>10</td>
</tr>
<tr>
<td>Thoroughness</td>
<td>3.47</td>
<td>1.21</td>
<td>11</td>
</tr>
<tr>
<td>Systematic</td>
<td>3.44</td>
<td>1.33</td>
<td>12</td>
</tr>
<tr>
<td>Dependable</td>
<td>3.43</td>
<td>1.23</td>
<td>13</td>
</tr>
<tr>
<td>Self-discipline</td>
<td>3.43</td>
<td>1.43</td>
<td>14</td>
</tr>
<tr>
<td>Integrity</td>
<td>3.41</td>
<td>1.22</td>
<td>15</td>
</tr>
<tr>
<td>Conscientious</td>
<td>3.38</td>
<td>1.37</td>
<td>16</td>
</tr>
<tr>
<td>Consistency</td>
<td>3.35</td>
<td>1.38</td>
<td>17</td>
</tr>
<tr>
<td>Honesty</td>
<td>3.30</td>
<td>1.29</td>
<td>18</td>
</tr>
</tbody>
</table>

Respondents reported that they had either observed or experienced the leadership attributes of hard work (mean=3.77), taking responsibility (mean=3.60) and being achievement-oriented (mean=3.57). They reported that they had sometimes observed or experienced the rest of the attributes (means ranging from 3.52 to 3.30) with honesty (mean=3.30) having the lowest mean. It is likely that honesty is becoming a rare trait in construction leadership. None of the attributes had been seen or experienced often to always, suggesting their lack of pervasiveness in the industry.
Unethical activities

Respondents were requested on a 5-point Likert scale of agreement where 1= strongly disagree, 2=disagree, 3=neutral, 4=agree and 5=strongly disagree, to indicate to what extent they agreed whether the 19 activities were unethical activities or not. Their responses are shown in Table 3.

Table 3. Questionable activities (n=60)

<table>
<thead>
<tr>
<th>Activity</th>
<th>Mean</th>
<th>SD</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Favouritism</td>
<td>3.61</td>
<td>1.69</td>
<td>1</td>
</tr>
<tr>
<td>Sexual harassment</td>
<td>3.58</td>
<td>1.84</td>
<td>2</td>
</tr>
<tr>
<td>Improper use of insider information</td>
<td>3.55</td>
<td>1.76</td>
<td>3</td>
</tr>
<tr>
<td>Fraud</td>
<td>3.50</td>
<td>1.85</td>
<td>4</td>
</tr>
<tr>
<td>Money laundering</td>
<td>3.48</td>
<td>1.85</td>
<td>5</td>
</tr>
<tr>
<td>Corruption</td>
<td>3.47</td>
<td>1.86</td>
<td>6</td>
</tr>
<tr>
<td>Discrimination</td>
<td>3.47</td>
<td>1.90</td>
<td>7</td>
</tr>
<tr>
<td>Use of intermediaries</td>
<td>3.46</td>
<td>1.68</td>
<td>8</td>
</tr>
<tr>
<td>Bribery</td>
<td>3.45</td>
<td>1.80</td>
<td>9</td>
</tr>
<tr>
<td>Environmental pollution</td>
<td>3.44</td>
<td>1.73</td>
<td>10</td>
</tr>
<tr>
<td>Nepotism</td>
<td>3.42</td>
<td>1.84</td>
<td>11</td>
</tr>
<tr>
<td>Receiving and giving gifts</td>
<td>3.40</td>
<td>1.64</td>
<td>12</td>
</tr>
<tr>
<td>Aggressive accounting</td>
<td>3.39</td>
<td>1.81</td>
<td>13</td>
</tr>
<tr>
<td>Conflicts of interest</td>
<td>3.39</td>
<td>1.86</td>
<td>14</td>
</tr>
<tr>
<td>Kickbacks</td>
<td>3.34</td>
<td>1.84</td>
<td>15</td>
</tr>
<tr>
<td>Extortion</td>
<td>3.32</td>
<td>1.84</td>
<td>16</td>
</tr>
<tr>
<td>Consumer product safety</td>
<td>3.25</td>
<td>1.75</td>
<td>17</td>
</tr>
<tr>
<td>Receiving and giving entertainment</td>
<td>3.22</td>
<td>1.56</td>
<td>18</td>
</tr>
<tr>
<td>Workplace health and safety</td>
<td>3.20</td>
<td>1.76</td>
<td>19</td>
</tr>
</tbody>
</table>

The range of means of responses (3.61 to 3.20) suggests that respondents reported mostly feelings of neutrality about each of the activities. Favouritism (mean=3.61), sexual harassment (mean=3.58) and improper use of insider information (mean=3.55) were the activities that respondents regarded most as unethical activities. Other activities that were blatantly unethical were not strongly regarded as such, for example, corruption (mean=3.47), bribery (mean=3.45) and nepotism (mean=3.42). Receiving and giving entertainment (mean=3.22) and workplace health and safety (mean=3.20) were seen as the least unethical of the 19 activities.

Influences on ethical behaviour, values and attitudes

Respondents were requested on a 5-point Likert scale of importance where 1= totally unimportant, and 5=extremely important, to indicate how important they regarded 20 factors/influences on ethical behaviour. Their responses ranked by the means are shown in Table 4. It is evident that respondents tended to place most importance on their own contribution to group behaviour and norms when those in management and supervisory positions conducted themselves ethically (mean=4.37), their dealings with others when those in management and supervisory positions conducted
themselves ethically (mean=4.26), the willingness of managers and supervisors to learn from their experiences (mean=4.00) and good examples set by managers and supervisors (mean=4.00). Also it is clearly seen that the ethical dynamics of Supervisory and Managerial influence is much stronger than that of inner personal values, attitudes; or most especially direct line peers.

Table 4. Factors/influences on ethical behaviour, values and attitudes (n=60)

<table>
<thead>
<tr>
<th>Factor/Influence</th>
<th>Mean</th>
<th>Std Dev</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>I contribute to group or organizational performance when those in authority or supervisory positions are ethical and fair in their dealings with me</td>
<td>4.37</td>
<td>0.79</td>
<td>1</td>
</tr>
<tr>
<td>Because my manager and supervisors are ethical and fair I reciprocate with others I interact with in the same way</td>
<td>4.26</td>
<td>0.95</td>
<td>2</td>
</tr>
<tr>
<td>Managers and supervisors are willing to learn from their experiences</td>
<td>4.00</td>
<td>1.16</td>
<td>3</td>
</tr>
<tr>
<td>Good examples are set by managers and supervisors</td>
<td>4.00</td>
<td>1.36</td>
<td>4</td>
</tr>
<tr>
<td>Managers and supervisors set and communicate high performance expectations</td>
<td>3.98</td>
<td>1.18</td>
<td>5</td>
</tr>
<tr>
<td>Managers and supervisors emphasize a strong sense of purpose</td>
<td>3.98</td>
<td>1.32</td>
<td>6</td>
</tr>
<tr>
<td>My managers and supervisors set an example on how to do things the right way in terms of ethics</td>
<td>3.90</td>
<td>1.34</td>
<td>7</td>
</tr>
<tr>
<td>Managers and supervisors emphasize a collective sense of mission</td>
<td>3.86</td>
<td>1.36</td>
<td>8</td>
</tr>
<tr>
<td>My managers and supervisors are good for the collective</td>
<td>3.84</td>
<td>1.27</td>
<td>9</td>
</tr>
<tr>
<td>Business ethics or values are discussed with employees by managers and supervisors</td>
<td>3.83</td>
<td>1.51</td>
<td>10</td>
</tr>
<tr>
<td>They treat people with respect</td>
<td>3.76</td>
<td>1.49</td>
<td>11</td>
</tr>
<tr>
<td>Workers speak up about issues of concern</td>
<td>3.74</td>
<td>1.31</td>
<td>12</td>
</tr>
<tr>
<td>My managers and supervisors treat people fairly</td>
<td>3.71</td>
<td>1.47</td>
<td>13</td>
</tr>
<tr>
<td>Everyone at work performs tasks that are expected of them</td>
<td>3.66</td>
<td>1.24</td>
<td>14</td>
</tr>
<tr>
<td>Managers demonstrate appropriate role-modelling behaviours</td>
<td>3.65</td>
<td>1.41</td>
<td>15</td>
</tr>
<tr>
<td>Everyone at work adequately completes assigned duties</td>
<td>3.54</td>
<td>1.26</td>
<td>16</td>
</tr>
<tr>
<td>Employees communicate their opinions about work issues to others even if their opinions are different and others at work disagree with them</td>
<td>3.47</td>
<td>1.26</td>
<td>17</td>
</tr>
<tr>
<td>Employees speak up and encourage others to get involved in issues that affect us at work</td>
<td>3.46</td>
<td>1.37</td>
<td>18</td>
</tr>
<tr>
<td>They use rewards to hold people responsible for appropriate conduct</td>
<td>3.17</td>
<td>1.51</td>
<td>19</td>
</tr>
<tr>
<td>I emulate the behaviour and attitudes of managers and supervisors who are not ethical and fair in their dealings with me</td>
<td>2.67</td>
<td>1.68</td>
<td>20</td>
</tr>
</tbody>
</table>
It is evident that the role of managers and supervisors cannot be ignored as the analysis of the data reflects that the leaders are seen as role models and are also used as a benchmark for what is acceptable and what is unacceptable ethical behaviour. The findings also suggest that there is a lack of two way communication and the leadership do not engage often with their subordinates on several issues, for example issues concerning business ethics and values (mean 3.83) as well as encouraging the workers to voice their concerns (mean 3.74). What is also interesting from the responses received is that employees tend not to emulate the behaviours and attitudes of unethical managers and supervisors (mean 2.67).

**Ethical lapses**

In Table 5, respondents were presented with 10 statements related to ethical lapses, using a 5-point Likert scale of agreement where 1= strongly disagree, and 5= strongly agree.

<table>
<thead>
<tr>
<th>Statement</th>
<th>Mean</th>
<th>Std Dev</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Negative consequences can be extremely far-reaching and can harm large numbers of completely innocent people</td>
<td>4.54</td>
<td>0.82</td>
<td>1</td>
</tr>
<tr>
<td>An ethical lapse at a minimum puts a permanent mark on an otherwise solid record of accomplishments and can outweigh years of seemingly good performance</td>
<td>4.46</td>
<td>0.82</td>
<td>2</td>
</tr>
<tr>
<td>The examples set by an organization’s leaders have a profound effect on the culture of the organization</td>
<td>4.25</td>
<td>0.96</td>
<td>3</td>
</tr>
<tr>
<td>Ethical lapses can be damaging to decision makers involved and to affected constituencies when the pre-lapse public reputation of the decision-makers was quite positive</td>
<td>4.11</td>
<td>1.01</td>
<td>4</td>
</tr>
<tr>
<td>The cover up is worse than the crime</td>
<td>4.07</td>
<td>1.07</td>
<td>5</td>
</tr>
<tr>
<td>We have a natural human tendency to fall victim to confirmation bias</td>
<td>3.93</td>
<td>0.90</td>
<td>6</td>
</tr>
<tr>
<td>Our tendencies to see what we want to see, not see what we do not want to see, and to hope a problem will go away on its own can plagues us in the long run and can lead to decisions that later come to be seen by others as ethically indefensible</td>
<td>3.93</td>
<td>1.00</td>
<td>7</td>
</tr>
<tr>
<td>What may be legal action may fall well short of the mark ethically or in the public’s sense of what is ethical</td>
<td>3.83</td>
<td>0.88</td>
<td>8</td>
</tr>
<tr>
<td>We see what we want to see in a given situation and not noting signs of a negative nature if such signs are not what we would prefer to see</td>
<td>3.83</td>
<td>1.03</td>
<td>9</td>
</tr>
<tr>
<td>The bigger they come the harder they fall</td>
<td>3.81</td>
<td>1.37</td>
<td>10</td>
</tr>
</tbody>
</table>
Respondents understood clearly the negativity and long reaching consequences of lapses (mean 4.54). They were aware of the loss in status and otherwise strong reputations once ethics is lapsed (mean 4.46). Issues of ignoring and not seeing unethical behaviour were agreed with less. The data also further suggest that subjects were able to distinguish between legal actions for ethical lapses and actual judgement or repercussions of ethical lapses (mean 3.83).

**Experience of unethical activities**

In Table 6 the responses of the respondents are shown relative to whether they had ever been exposed to or witnessed 19 unethical activities. The findings show that participants reported workplace health and safety as having been mostly experienced or witnessed, and had the least amount of experience or exposure to the more obvious unethical activities such as corruption, fraud and money laundering.

Table 6. Experience of unethical activities (n=60)

<table>
<thead>
<tr>
<th>Activity</th>
<th>Yes</th>
<th>No</th>
<th>Maybe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Workplace health and safety</td>
<td>66.1</td>
<td>16.9</td>
<td>16.9</td>
</tr>
<tr>
<td>Consumer product safety</td>
<td>59.3</td>
<td>16.9</td>
<td>23.7</td>
</tr>
<tr>
<td>Receiving and giving gifts</td>
<td>47.5</td>
<td>39.0</td>
<td>13.6</td>
</tr>
<tr>
<td>Receiving and giving entertainment</td>
<td>45.8</td>
<td>44.1</td>
<td>10.2</td>
</tr>
<tr>
<td>Discrimination</td>
<td>39.0</td>
<td>59.3</td>
<td>1.7</td>
</tr>
<tr>
<td>Environmental pollution</td>
<td>36.2</td>
<td>44.8</td>
<td>19.0</td>
</tr>
<tr>
<td>Conflicts of interest</td>
<td>35.6</td>
<td>52.5</td>
<td>11.9</td>
</tr>
<tr>
<td>Favouritism</td>
<td>35.6</td>
<td>49.2</td>
<td>15.3</td>
</tr>
<tr>
<td>Bribery</td>
<td>30.5</td>
<td>57.6</td>
<td>11.9</td>
</tr>
<tr>
<td>Corruption</td>
<td>28.8</td>
<td>61.0</td>
<td>10.2</td>
</tr>
<tr>
<td>Sexual harassment</td>
<td>25.4</td>
<td>71.2</td>
<td>3.4</td>
</tr>
<tr>
<td>Kickbacks</td>
<td>25.4</td>
<td>64.4</td>
<td>10.2</td>
</tr>
<tr>
<td>Improper use of insider information</td>
<td>25.4</td>
<td>61.0</td>
<td>13.6</td>
</tr>
<tr>
<td>Use of intermediaries</td>
<td>22.4</td>
<td>60.3</td>
<td>17.2</td>
</tr>
<tr>
<td>Nepotism</td>
<td>16.9</td>
<td>69.5</td>
<td>13.6</td>
</tr>
<tr>
<td>Aggressive accounting</td>
<td>15.5</td>
<td>69.0</td>
<td>15.5</td>
</tr>
<tr>
<td>Fraud</td>
<td>15.3</td>
<td>76.3</td>
<td>8.5</td>
</tr>
<tr>
<td>Money laundering</td>
<td>13.6</td>
<td>74.6</td>
<td>11.9</td>
</tr>
<tr>
<td>Extortion</td>
<td>11.9</td>
<td>76.3</td>
<td>11.9</td>
</tr>
</tbody>
</table>

**Observations**

This study set out to highlight the pervasiveness of behaviours that would create a framework of understanding ethics and its paradigms, with the eventual aim of improving best business practice, not only within the construction industry but in professional practice as a whole.
The findings of this study remain sketchy, but it paints a picture of awareness. In any issue of awareness, it is the initial paradigm leap into basic mindfulness that sets a concept on a path towards eventual full understanding. People inherently know what is ethical and what is not, based on their value systems as human beings. But, how this translates into the Construction Industry remains an area for further investigation. In this light, a quantitative analysis may be sufficient to begin the understanding, but deeper enquiry in terms of in-depth qualitative work will further add strength to this highly relevant and important issue of ethics, which cannot be ignored.

References


ABSTRACT AND KEYWORDS

Purpose
The aim of this research was to examine how effective management of Contractor-Supplier relationship will result in improved performance of projects in the Zambian Construction Industry (ZCI).

Design/Methodology
A questionnaire survey was used to collect data. Both qualitative and quantitative research methods were adopted.

Research limitations/implications
The total number of respondents that were targeted may not be representative of the ZCI and the research only focused on two (2) provinces out of the ten (10).

Findings based on Empirical Research
The findings revealed that Contractor-Supplier relationship in the ZCI is short-term and negatively affects the projects quality and costs. One of the contributing factors is the lack of problem sharing among the parties.

Response to conference theme and outcomes
Project delivery involves a number of parties which include the contractor and suppliers. Thus if performance is to be improved on projects, the focus must be on improving these relationships.

**Practical implications**
In order to improve project delivery, parties must build trust, good communication, joint problem solving and long-term commitment.

**Key Words** – Contractor, Supplier, Relationship, Zambian Construction Industry

1. **Introduction**
Construction involves a fragmented team and the main parties involved include the client, consultants, contractors, sub-contractors and suppliers. The involvement of many parties on a project makes it difficult to coordinate a project and this result into poor performance of construction projects (Pala et al. 2012). This has been a concern in most countries especially that the industry contributes to any country’s economic growth (Enshassi et al. 2009). Despite the significance of this industry, its performance has been underachieving and Zambia is no exception to such (Che and Wang 2008). Hence it is imperative that relationships amongst the key project parties are managed efficiently to ensure that the project performance is improved. Unarguably, one of the most important relationships is the Contractor-Supplier Relationship (CSR). This is because studies have shown that a large percentage of the contractor’s project turnover is spent on buying goods and services (Che and Wang, 2008; Bemelmans 2012).

Importantly, with demand for projects such as housing, educational, roads and commercial facilities increasing, this inevitably calls for collaboration and management of suppliers by contractors realizing that the industry is highly fragmented (Bemelmans, 2012; Errasti et al, 2009). Further, clients’ demands are shifting from a focus on just price to include innovation, sustainability and speed of construction. Consequently, contractors require capabilities and knowledge which do not belong to their own core competence and therefore need to acquire from suppliers if they are to meet clients’ needs (Bemelmans, 2012).

Hence to improve performance studies have shown that management of downstream relationships should be targeted by contractors (Kamaruzzaman, 2010; Bemelmans et al. 2012). Further Frodell (2009) recommends that contractors’ need to make efforts in building partnerships and long-term relationships not only with clients but also with suppliers. Wagner and Hoegl (2006) also support this fact that the improvement of CSR improves project performance. The current situation in the construction industry however is that even with this realization, collaborative relationships remain short-term (Kamaruzzaman, 2010) a feature which can also be related to the Zambian Construction Industry (ZCI). Hence the objective of this research was to establish the nature of
the CSR with the aim of improving it in order to improve project performance. The research also focused on contributing to the knowledge on management of CSR in the ZCI which is limited.

2. Nature and Management of CSR

In a typical construction supply chain a number of actors are connected together through multiple and dynamic relationship layers such as product, information or material flows, contractual relationships, monetary relationships, and social networks (Bemelmans, 2012; Pala et al. 2012). However, for this study, CSR can be categorised as being transactional relationship, series relationship and long term partnerships (Pala et al. 2012; Joseph et al, 2010). Further, many researchers have taken a keen interest in how CSR could be managed with the realization of the link between effective management of this relationship and the performance of the firm (Bemelmans et al. 2012). Evidently several aspects are crucial and one notable aspect is good communication since construction involves information exchange among the parties (Emberson and Storey 2006). Importantly, a closer, more collaborative relationship with fewer partners provides an environment in which parties closely co-operate rather than compete to achieve mutual goals since it is possible to share and demand confidential information (Frodell 2009). This reduces uncertainty in material and lowers costs and order cycle time. Other factors that can be considered when managing CSR including the following;

- **Focussing On a Trust-Based Relationship** - Each party should believe that the other party is reliable in executing the work and fulfil its obligations (Bemelmans, 2012).
- **Long-Term Commitment** - Helps to establish an innovation-friendly climate and value creation (Eom et al 2008; Barratt 2004).
- **Developing Suppliers** – Create opportunities for improvement and then facilitating performance improvements to suppliers (Frodell and Josephson 2009).
- **Joint Problem Solving** - This improves relationships and performance because it is more likely to lead to a win-win situation between the parties (Bemelmans, 2012; Frodell 2009).

2.1.0 Factors Affecting Contractor Supplier Relationship

Manufacturing companies tend to build long-term relationships with their suppliers as there are benefits to it, such as reduced costs and increased competitiveness. Unfortunately for the construction industry this has proved
to be a challenge due to the constraints which are related to its nature. These include lack of standardized procurement on various projects, increased supplier base, total volume of sales involved, material specifications by clients and different geographical location (Frodell and Josephson 2009). Further, contractors feel that while long-term thinking is favourable for reducing transaction costs and increased productivity, the measurements and incentives systems still drive the organization to a short-term perspective regarding supplier relations. This is because the industry offers single and unique products in temporary factories and organizations are constantly renewed hence the biasness to short term relationships (Frodell and Josephson, 2009). However, such relationships have been known to lead to poor performance of the industry, thus the importance of managing CSR cannot be overemphasized.

3. Factors Affecting Project Performance

There are many factors that affect performance of construction projects. Some of these include shortage of skills of manpower, poor supervision and site management, shortage and breakdown of equipment and contractors’ financial challenges (Faridi and El-Sayegh 2006; Enshassi et al 2009). Conflict, poor workmanship and incompetence of contractors are also among the factors which negatively impact on project performance (Pala et al. 2012). Pheng and Chuan (2006) also note that a poor relationship between project parties also affects project performance. Importantly, Bemelmans (2012) also noted that short-term relationships between contractors and suppliers also leads to poor performance of the project and this results in many problems in construction which include poor cooperation, lack of trust and ineffective communication. This consequently leads to poor quality and time and cost overruns. It must be mentioned that improving contractor supplier relationship will not solve all factors affecting project performance, but this will solve those problems that are related to materials such as delayed materials, poor quality and shortage of materials. Some problems that also relate to financing for contractors will also be solved in the sense that with well established contractor client relationships, the contractor can negotiate for trade credit or discount facilities.

4. Benefits of Improved Contractor Supplier Relationship

There are number of benefits that accrue due to improved contractor supplier relationship. For instance material suppliers usually have in-depth knowledge about the characteristics of their materials that a contractor is not likely to have such as availability, sourcing and other alternatives (Frodell and Josephson, 2009). By also giving feedback the contractor can
recommend how the suppliers should invest in order to produce better quality and more desirable materials. This improves quality of future products. Further, when there is trust and good communication between the contractor and supplier, order placement, conformation of orders and delivery of materials can be done by the supplier faster. This results in uninterrupted flow of the works ultimately improving the project performance (Bemelmans, 2012).

5. Research Methods and Findings

The research methods used included both qualitative and quantitative. A questionnaire survey was conducted using structured interviews and self-administered in order to have a face to face discussion and probe further when necessitated.

5.1 Target Population and Sample Size.

Since the population of interest (consultants and contractors) was divided into homogenous subgroups based on one or a number of attributes, stratified sampling was used. In effect the sampling frame is divided into a number of subsets called strata (Kumar 2005). These included consultants (27) (architects and quantity surveyor using) contractors (25). Suppliers (25) were selected using purposive sampling method. Purposive sampling, a non probability sampling method, was considered for the selection samples from material supplier and contractors. This was done primarily to ensure that different groups of a population are adequately represented in the sample so that the level of accuracy is increased. The response rate from the total numbers sampled was 68%.

5.2 Data Analysis

Both qualitative and quantitative methods were used in data analysis in order to reinforce the others shortfalls. This included the relative importance index (RII) as shown in equation 1.1 which was combined with the discourse method to analysis the data.

\[
\text{RII} = \frac{5n_5 + 4n_4 + 3n_3 + 2n_2 + 1n_1}{5(n_1 + n_2 + n_3 + n_4 + n_5)} \times 100
\]

Equation 1 – Relative Importance Index Source - Donkor 2011

Where; \( n_1 \) = Number of respondents who answered “Very Low Contributing” 
\( n_2 \) = Number of respondents who answered “Low Contributing”
n3 = Number of respondents who answered “Medium Contributing”
n4 = Number of respondents who answered “High Contributing”
n5 = Number of respondents who answered “Very High Contributing”

5.3 Research Limitations:
The total number of 75 respondents that were targeted may not be representative of the ZCI and the research only focused on two (2) provinces out of the ten (10).

6. Research Findings and Discussion
The findings are discussed under contractors’ and suppliers’ and consultants responses as follows;

6.1 Contractors’ and Suppliers’ Responses
Factors that affect performance of construction projects

From table 1.1 the factor contractors considered to be important to project performance is the quality of materials delivered. Hence, suppliers who providing good quality will thus enhance the performance of construction. Though relationships between parties is ranked second last, it is still a factor which was noted by the respondents. It thus can be inferred that suppliers have a significant influence on the success of a project which calls for better managed CSR. This is also similar to what other researchers have established (Frodell 2009; Wagner and Hoegl 2006). Unfortunately it (CSR) is given little attention as established by Bemelmans et al. (2012).

<table>
<thead>
<tr>
<th>FACTOR/RANK</th>
<th>RII</th>
<th>Rank (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quality of raw materials</td>
<td>3.6</td>
<td>72</td>
</tr>
<tr>
<td>Conformance to specification</td>
<td>3.4</td>
<td>68</td>
</tr>
<tr>
<td>Delayed payment from owner to contractor</td>
<td>3.5</td>
<td>70</td>
</tr>
<tr>
<td>Information Coordination among Owner and</td>
<td>2.8</td>
<td>56</td>
</tr>
<tr>
<td>Project Parties</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Relationship between parties to a contract</td>
<td>3.0</td>
<td>60</td>
</tr>
<tr>
<td>Changes of Prices of Materials and equipment</td>
<td>3.7</td>
<td>74</td>
</tr>
</tbody>
</table>

Factors Considered to Measure Project Performance

The respondents indicated that quality (96%) and time (96%) are the factors that are considered most when measuring performance of construction projects. CSR (56%) was ranked the least whilst health and...
safety and cost where ranked to be 3rd and 4th respectively. It can be inferred that the ZCI does not put much emphasis on improving the CSR even when it is well known that it affects the performance of a project because it has not been recognized as a major factor which also corresponds with Bemelmans et al. (2012) findings that the construction industry rarely conducts research and emphasis on CSR. Hence it is hoped that more emphasis can be made on improving CSR in order to improve project performance in the ZCI.

Establishing whether the relationship is short-term or long-term

78.9% of contractors indicated that they have short-term relationship with suppliers while 60% of the suppliers indicated that they have short-term relationship with their contractors. Hence, it can be concluded that CSR is short term in the ZCI. Realizing the influence this has on the project performance, it is imperative that this situation is addressed.

Effects of Relationship on Performance

All respondents indicated that the effect of short term contractor-supplier relationship on the project is negative on the parameters of cost (57.1%), time (50%) and quality (49.2). The respondents also indicated that where relationships are long term based, there is better quality (88%), reduced costs (65%) and reduced delays (91%). Responses from the suppliers (66.7) also indicated that project cost is affected negatively, 46.7% felt project completion time is affected negatively and 53.3% believe project quality is affected negatively. This clearly illustrates the importance of encouraging long term contractor-client relationships since short term CSR results into reduced quality and increased cost and time.

Reasons Leading to Short Term Relationships

Respondents were asked to list factors that contribute to short-term relationships; lack of credit facilities was the most dominant reason given followed by lack of trust on both parties (contractor and supplier). Change in location of projects was also cited. Hence, besides CSR related factors, it was also established that the nature of the project, such as location and type of materials specified, also hindered the tenure of the CSR.

Factors that Lead to Long-Term Relationship

The factors are summed up in table 1.2.

Table 1.2 Factors Needed for Establishing Long Term Relationships
The contractors ranked transparency as the highest factor at 80%, followed by good communication (74%) and in third (70%) long-term commitment. Joint problem solving was the least with 52%. This is in agreement with the factors identified by the suppliers who indicated that trust, 76%, Good communications 72%, and long-term commitment 72% have a an influence on when establishing long term relationships. Hence, if long term CSR are to be established in the ZCI, it is important that trust, good communication and long-term commitment are developed.

### 6.2 Findings from Consultants

From the data collected, the following are the findings from the consultants;

**Factors Affecting Project Performance**

From table 1.3, delayed payment was ranked as the highest factor; information coordination was 2nd with quality of materials being the 3rd. Even though CSR was ranked 4th, it was evident enough that CSR affects performance of construction projects since they provide materials.

<table>
<thead>
<tr>
<th>FACTORS</th>
<th>RII</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quality of Raw Materials</td>
<td>3.9</td>
</tr>
<tr>
<td>Conformance to Specifications</td>
<td>3.3</td>
</tr>
<tr>
<td>Relationship Between Contractors and Suppliers</td>
<td>3.4</td>
</tr>
<tr>
<td>Information Coordination among Owner and Project Parties</td>
<td>4.1</td>
</tr>
<tr>
<td>Changes of Prices of Materials and equipment</td>
<td>3.2</td>
</tr>
<tr>
<td>Delay in Payment from Owner to Contractor</td>
<td>4.8</td>
</tr>
</tbody>
</table>

Besides, one of the major setbacks of delayed payments is that it affects the supplier relationships since contractors are not able to honour their dues on time. In comparison with the contractor and supplier findings in table 1.1 CSR as factor was also ranked lowly. This affirms the fact that the industry does not really focus on improving it. This can be noted from table
1.3, were it is also ranked 4th in relation to its impact on a project. It affects performance to a greater extent in that, the three factors ranked higher can be improved significantly with an improved CSR. For instance, effective management of the relationship that exists between contractors and suppliers can results in minimization in delayed delivery of materials and improved quality of materials.

Factors Considered When Measuring Project Performance

From the findings in table 4.1 it can be noted that most of the consultants consider mostly time, cost and quality when measuring performance of construction projects in Zambia and that CSR is not one of the prime factors. This was as a similar finding among contractors and suppliers. One of the contributing factors given by the respondents was that parameters on which relationships can be measured are not well known by most of them. It is therefore important that industry continues to advocate for improved supply chain management focusing on CSR as recommended by Bemelmans et al. (2012) and Frodell (2009).

<table>
<thead>
<tr>
<th>FACTOR</th>
<th>RII</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quality</td>
<td>4.8</td>
</tr>
<tr>
<td>Contractor-Supplier relationship</td>
<td>2.8</td>
</tr>
<tr>
<td>Time</td>
<td>4.8</td>
</tr>
<tr>
<td>Cost</td>
<td>4.6</td>
</tr>
<tr>
<td>Health and safety</td>
<td>3.7</td>
</tr>
</tbody>
</table>

Establishing whether the relationship is short-term or long-term

65% of the consultants indicated that there is a short-term relationship between contractors and their suppliers. This was also corresponding with the contractors (78%), who indicated short-term relationship with suppliers. Thus CSR in the ZCI can be concluded to be short term.

Effects of short-term relationship on project performance

65% of the consultants affirmed that a short term relationship affects project cost, time and quality negatively which corresponds with the findings from the contractors and suppliers. This is because contractors will take time to make new relationships with suppliers who will not be keen to give services such as trade credits. In other circumstances, this may result in delayed procurement of materials or opt for cheaper but poor quality materials. This ultimately affects the quality, cost and time of the project.
Consultants’ Main factors that influence long-term relationship

The consultant’s ranked trust between the suppliers and the contractors as the main contributing factor which was followed by good communication between the two parties. The third was joint problem solving. Hence building trust among the two parties remains cardinal in ensuring that long term CSR are forged. Good communication and joint problem solving is also needed to ensure that all the parties involved know that the relationship is a win-win one, essentially benefits all those involved.

7. Research Summary

Based on the findings the CSR in the ZCI is short term and this affects performance of construction projects. From the findings it can further be observed that most of the contractors consider mostly time, cost and quality when measuring performance of construction projects and that project parties relationships is not very much considered. A feature also noted by Bemelmans et al. (2012) that the industry generally does not pay attention to parties’ relationship including in research work. Further, to improve and manage CSR, factors that can be considered to foster a long-term relationship include trust, good communication, joint problem solving and long-term commitment. It was also noted that there are project related factors that affect CSR such as project location and uniqueness. Hence not all project problems can be mitigated through improved CSR. On the other hand, though improved CSR is not the general solution to all the problems within the ZCI, this can be considered to improve performance of projects by solving challenges related to the CSR. This can be noted from the fact that with improved CSR, the contractors can improve on the timely delivery of materials, consequently reducing the project duration. Realizing the benefits that accrue to the contractor, supplier and the client, it is imperative that all the parties work towards establishing long term relationships through joint problem solving, trust and improved communication. Further, suppliers must be involved as early as possible so that their knowledge can be utilized in the early stages of the project. The ZCI also lacks in tools of improving the supply chain. Hence it is recommended that for future research, supply chain management among the local contractors be researched upon.

8. REFERENCES


Risk Management Practices on Building Projects in the Zambian Construction Industry (ZCI)

Chipozya K. Tembo and Nthatisi Khatleli
Chipozya@yahoo.co.uk, Nthatisi.Khatleli@wits.ac.za
Department of Construction Economics and Management, University of the Witwatersrand, Tel No. +27 0117177669.

ABSTRACT AND KEYWORDS

Purpose of this paper
Risk management is a vital process in the management of projects. Nevertheless, how risk management is carried out has an impact on the success of a project. Various scholars have concluded that well managed risks impacts positively on projects. Moreover, completion of a construction project within time, cost and to the desired quality, are the key indicators of good project delivery. However, the construction industry seldom delivers projects within the aforementioned parameters due to risks.

Design/methodology/approach
The study was based on a questionnaire survey and semi-structured interviews of consultants and contractors.

Findings
The most utilised stage in the risk management cycle is risk identification mainly making use of experience from past projects and local knowledge. Other stages such as risk analysis and monitoring are rarely done. The most utilised methods of responding to risk are; insurance, contingency sums, percentages added to rates and on occasion projects are abandoned.

Research limitations/implications (if applicable)
The study only used building projects as a basis for establishing practices used for risk management in the ZCI.

Practical implications (if applicable)
The identification of stages and practices in risk management process is a first stage in discovering shortcomings in current risk management practice thereby identifying areas for improvement
What is original/value of paper.
The research identifies areas where professionals need to improve their risk management skill and subsequently, practices to improve the delivery of building projects e.g. quantitative risk analysis and monitoring.

Keywords: Risk management, Practices, Buildings, Construction.

1. INTRODUCTION

Infrastructure development is a major concern for many countries more so developing countries. The current focus on research is mainly on economic infrastructure such as: transport infrastructure, telecommunication, sanitation and energy. Other ordinary infrastructures such as schools, hospitals, housing, offices, prisons, service stations are also very important for the development of any nation yet are hardly researched on. Infrastructure development of any magnitude is normally affected by risks (Sharma, 2006). Risks when poorly managed result in claims, disputes, quality shortfalls, cost and time overruns (Alsalman & Sillars, 2013).

Construction projects in the Zambian construction industry have exhibited quality shortfalls, time and cost overruns (Auditor generals office, 2009; Auditor Generals' Office, 2013; Kaliba, et al., 2013) and claims are also rampant (Sibanyama, et al., 2012). In addition, there is evidence that on occasions there is mishandling of risk; and these are majorly allocated to the contractor (Sibanyama, et al., 2012) when standard forms of contract clearly state that these should be handled by the client. This shows disparity between regulations and implementation. All these could be minimised by formalised and systematic risk management (Project Management Institute, 2004). Moreover, informal practices of risk management results in poor quality, low productivity and cost overruns (Choudhry, et al., 2014). Nevertheless, Construction organizations in developing countries, approach risk management in construction projects by using practices that are typically inadequate, produce poor results frequently, and limit the realisation of desirable project outcome (Serpel, et al., 2015). This research aims to discover the practices used for risk management in the Zambians building sector with a view of identifying improvement areas so as to enhance the management of risk in the sector.

1.1 Risk

Risk is generally defined as "the possibility of incurring misfortune or loss [or] hazard" (Butler, 2013). Cano and Cruz (2002) define it as "an uncertain event that, if it occurs, has a positive (opportunities) or negative (threats) effect on a project objective" (p. 497). Generally risk in the construction industry is perceived to be a combination of activities that adversely affect the project objectives of time, cost, scope and quality (Ehsan, et al., 2010). Risks in the construction industry could have
physical, monetary, cultural and social dimensions (Choudhry & Iqbal, 2013). Therefore various categories of risk exist e.g. financial and economic, physical, technological, legal, social-cultural, managerial, technical, environmental, political etc. (Sharma, 2006). These have to be managed using a formal and systematic risk management process so that project delivery is not adversely affected (Project Management Institute, 2004).

1.2 Risk Management

Risk Management (RM) is "the logical method of establishing the context and of identifying, analysing, evaluating, treating, monitoring and communicating the risk involved within any activity, function or process in a way that enable losses to be minimised and opportunities to be maximised" (AS/NZS 4360, 1999). Therefore, the risk management process is fundamentally a positive and proactive process intended to reduce the likelihood of unsatisfactory consequences to the project in its different stages of design, construction and operation (Serpel, et al., 2015). Figure 1 shows the risk management process.

![Figure 1 Risk Management Process](image_url)

2. RISK MANAGEMENT PRACTICES

Practice according to the online business dictionary refers to a *method, procedure, process or rule* used in a particular field or profession (Business dictionary, 2015). Processes for risk management include: establishing context; risk assessment (risk identification, analysis, and risk evaluation); risk treatment; risk monitoring and communication.

<table>
<thead>
<tr>
<th>Process</th>
<th>Consideration</th>
<th>Methods/rules/Procedure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Establish the context</td>
<td>Establish the strategic, organisational and risk management context in which the rest of the process will take place. Criteria against which risk will be evaluated should be established and the</td>
<td>Risk policy, risk frameworks such as RISKMAN, PRAM, RAMP (Project Management Institute, 2004; Fidan, et al., 2011)</td>
</tr>
</tbody>
</table>
### Table of Risk Analysis Processes

<table>
<thead>
<tr>
<th>Process</th>
<th>Description</th>
<th>Methods</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Identify risks</strong></td>
<td>Identify, what, why and how things can arise as the basis for further analysis.</td>
<td>Brain storming, interviews, specialists, SWOT analysis, feedback, workshops, prompt lists questionnaires, Delphi group, nominal group techniques and varying diagrammatic techniques (cause &amp; effect; influence diagram) (Barlish, et al., 2013)</td>
</tr>
<tr>
<td><strong>Analyze risks</strong></td>
<td>Determine the existing controls and analyse risks in terms of consequences and likelihood in the context of those controls. The analysis should consider the range of potential and how likely those consequences are to occur. Consequences and likelihood may combine to produce an estimated level of risk</td>
<td>Quantitative: probability analysis, sensitivity analysis, simulation analysis and scenario analysis; qualitative technique: Direct judgement, ranking options, comparing options, descriptive options fuzzy logic and bayesian networks (Imbeah &amp; Guikema, 2009).</td>
</tr>
<tr>
<td><strong>Evaluate risks</strong></td>
<td>Compare estimated levels of risk against the pre-established criteria. This enables risks to be ranked so as to identify management priorities. If the levels of risk established are low, then risks may fall into an acceptable category and treatment may not be required.</td>
<td>Quantitative: probability analysis, sensitivity analysis, simulation analysis and scenario analysis; qualitative technique: Direct judgement, ranking options, comparing options, descriptive options, fuzzy logic and bayesian networks (Imbeah &amp; Guikema, 2009).</td>
</tr>
<tr>
<td><strong>Treat risks</strong></td>
<td>Accept and monitor low-priority risks. For other risks, develop and implement a specific management plan which includes consideration of funding. The general rule is to allocate risks to the best party able to manage. (Mead, 2007)</td>
<td>Allocation Options accept, eliminate, transfer, and share (Mead, 2007). Response Mechanisms: contingency sum/float, subcontracting, partnering, procurement methods, method of construction, insurance, bonds, guarantee and warrantees, (Bakr &amp; Ayda, 2012)</td>
</tr>
<tr>
<td><strong>Monitor and Review</strong></td>
<td>Monitor and review the performance of the risk management system and changes which might affect it.</td>
<td>Inspection and supervision (Serpel, et al., 2015)</td>
</tr>
<tr>
<td><strong>Communicate and consult</strong></td>
<td>Communicate and consult with internal and external stakeholders as appropriate at each stage of the risk management process and concerning the process as a whole.</td>
<td>Meetings, reports, letters hardcopy/electronic (Project Management Institute, 2004)</td>
</tr>
</tbody>
</table>

Within these processes various methods and/or rules apply for instance quantitative risks may use quantitative methods of analysis while perhaps the client may apply certain rules during the risk treatment stage to allocate risk such as ability to manage risk or the ownership of the risk. Practices used in any environment must be fitted to existing work practices and project environment to enable the smooth implementation and systematic utilization of practices (Shi, et al., 2014). Moreover, the uniqueness and dynamism of the construction operation involves numerous uncertainties, multiple intricacies, various techniques and divergent environments (Jarkas and Haupt, 2015). These therefore call for the use of appropriate risk
management practices. Table 1 is a summary of the various risk management practices.

3. METHODOLOGY

The study used both a qualitative and quantitative approach through the use of semi-structured interviews and questionnaire survey to garner an understanding of risk management practices used in the building sector. For the interviews the sample comprised of 11 purposively sampled players in the industry who had 10 years’ experience in the building sector from both public and private sector namely (see table 2): consultant firms - quantity surveyor (QS), Engineers (ENG), Project Manager (PM) and Architects (Arc)] and contracting firms (Ktor) from building category (grade 1-3).

Table 2 Respondent’s characteristics (interview)

<table>
<thead>
<tr>
<th>Respondent</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sector</td>
<td>Pub</td>
<td>Pub</td>
<td>Pub</td>
<td>Pri</td>
<td>Pri</td>
<td>Pri</td>
<td>Pub</td>
<td>Pri</td>
<td>Pri</td>
<td>Pri</td>
<td>Pri</td>
</tr>
<tr>
<td>Experience in Years</td>
<td>15</td>
<td>12</td>
<td>20</td>
<td>19</td>
<td>10</td>
<td>32</td>
<td>23</td>
<td>30</td>
<td>29</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Role</td>
<td>QS</td>
<td>ENG</td>
<td>QS</td>
<td>Arc</td>
<td>Ktor</td>
<td>PM</td>
<td>PM</td>
<td>ENG</td>
<td>Ktor</td>
<td>Ktor</td>
<td>Arc</td>
</tr>
</tbody>
</table>

Table 3 Respondents profile (questionnaire survey)

<table>
<thead>
<tr>
<th>Category (firms) engaged in buildings</th>
<th>Firms</th>
<th>Population</th>
<th>Responses</th>
<th>Response rate %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contractors Building Category</td>
<td>150</td>
<td>79</td>
<td></td>
<td>52.6%</td>
</tr>
<tr>
<td>Consultants Quantity surveyor</td>
<td>36</td>
<td>32</td>
<td></td>
<td>88.9%</td>
</tr>
<tr>
<td>Engineers</td>
<td>32</td>
<td>28</td>
<td></td>
<td>87.5%</td>
</tr>
<tr>
<td>Architects</td>
<td>54</td>
<td>38</td>
<td></td>
<td>70.4%</td>
</tr>
<tr>
<td>Project managers</td>
<td>17</td>
<td>14</td>
<td></td>
<td>82%</td>
</tr>
</tbody>
</table>

The questionnaire survey used closed and open-ended questions on randomly selected contractors registered with the National council for construction (NCC) as at 14 August 2014 in the building sector and registered consultancy firms (See Table 3). The players selected had engaged in various building construction types; residential, commercial, industrial and others, thus providing a good mix for the study. An exploratory (semi-structured interviews) and explanatory (questionnaire) mixed method approach was taken to understand the risk management practices and how wide spread they are (Creswell, 2009). The qualitative data was analysed using content analysis (through the identification of recurrent themes and interpretive analysis to get implied meaning); and the quantitative data made use of descriptive statistics (Gray, 2009) such as means, frequency modes.

4. DISCUSSION
4.1 Context of Risk Management
Various risk management frameworks exist in the literature; however from the results shown in the table 4 below very few firms in the Zambian construction industry have an established risk management system.

<table>
<thead>
<tr>
<th>Use of established Risk Management System</th>
<th>Contractors</th>
<th>Engineers</th>
<th>QS</th>
<th>Architect</th>
<th>PM</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>38</td>
<td>10</td>
<td>7</td>
<td>6</td>
<td>8</td>
<td>69 (36.1%)</td>
</tr>
<tr>
<td>No</td>
<td>41</td>
<td>18</td>
<td>25</td>
<td>32</td>
<td>6</td>
<td>122 (63.9%)</td>
</tr>
<tr>
<td>Total</td>
<td>79</td>
<td>28</td>
<td>32</td>
<td>38</td>
<td>14</td>
<td>191 (100%)</td>
</tr>
</tbody>
</table>

The implication is that risk management in the industry is not systematic and is un-formalised. Moreover, only 1.5% of the firms claimed to follow their company risk management policy. While nearly 5% of the consultants indicated that they depend on contract provisions such as bonds, guarantees and insurance to manage risks. This could explain why the industry is marred with poor project delivery as not all risks are contractual. This brings into question the mechanisms used to manage non contractual risk.

4.2 RISK ASSESSMENT METHODS

4.2.1 Risk identification
To effectively manage risk in the construction industry, it is crucial to correctly identify important risks (Andi 2006). The Table below shows the methods used to identify risks on building projects. It shows that the most utilised methods for risk identification on buildings are site visits, past projects, local knowledge, expert knowledge and brainstorming. However, from the interviews conducted it was demonstrated that on occasion designs are completed and contracts awarded without the consultants and contractor ever going to site. The site handover under these circumstances is the day both parties actually go to site. This means that circumstances such as physical features (trees, rocks, anthills etc.) are not accounted for and furthermore, site investigations are not conducted. It was indicated that such circumstances affect project delivery negatively. Of the methods frequently used to identify risks, there are a few that account for consequential risks such as influence diagrams. It is therefore important to adopt the use of risk maps to be able to appreciate and adequately deal with consequential risks (Yildiz, et al., 2012.).

<table>
<thead>
<tr>
<th>Method</th>
<th>QS</th>
<th>Eng.</th>
<th>Arch</th>
<th>PM</th>
<th>Contractor</th>
<th>Total</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brainstorming</td>
<td>24</td>
<td>15</td>
<td>25</td>
<td>8</td>
<td>48</td>
<td>120</td>
<td>61</td>
</tr>
<tr>
<td>Delphi Technique</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>5</td>
<td>3</td>
</tr>
</tbody>
</table>
4.2.2 Risk analysis and evaluation

Risk analysis sets out to quantify the effects of major risks that have been identified and sets out to understand the risks (Mead, 2007). Risk evaluation is the process used to compare the estimated risk against the given risk criteria so as to determine the significance of the risk (ISO31000).

<table>
<thead>
<tr>
<th>Table 4 Methods of risks analysis used on building projects</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Method of Analysis</strong></td>
</tr>
<tr>
<td>Brainstorming</td>
</tr>
<tr>
<td>Probability Impact matrix</td>
</tr>
<tr>
<td>Expert Judgment</td>
</tr>
<tr>
<td>Risk Break down structure</td>
</tr>
<tr>
<td>Checklist</td>
</tr>
<tr>
<td>Interviews</td>
</tr>
<tr>
<td>Consult Specialist</td>
</tr>
<tr>
<td>Risk Premium</td>
</tr>
<tr>
<td>Intuition</td>
</tr>
<tr>
<td>Judgment Risk Analysis Process</td>
</tr>
<tr>
<td>Probability Distribution</td>
</tr>
<tr>
<td>Sensitivity analysis</td>
</tr>
<tr>
<td>Monte Carlo simulation</td>
</tr>
</tbody>
</table>

To be able to appreciate the impact or significance of identified risks; risk analysis and evaluation has to be carried out and Table 6 shows the methods used. From the indicated frequencies in Table 6 it appears that risk analysis and evaluation are not common practices compared to risk identification. This was affirmed by the semi-structured interviews. The top methods used by over 50% of the respondents include; Expert judgement, Brainstorming, and consult specialist. The first two methods are subjective as they depend on experiences of respondents (Sharma, 2006). Less subjective methods need to be adopted for use to arrive at objective decisions. Nevertheless, the interviews revealed that risk analysis in not done because players have no know-how of how most methods can be
applied. Therefore training is needed in the area of quantitative risk management.

4.3 RISK TREATMENT/RESPONSE

Risk treatment is the process of selecting and implementing of measures to modify risk. The risk treatment measures can include avoiding, optimizing, transferring or retaining risk (Project Management Institute, 2004). The measures are operationalised by having risk response options. Risk response process develops strategic options, and determines actions, to enhance opportunities and reduce threats to the project's objectives (Project Management Institute, 2004). The assigning of management responsibility and liability is done for project participants and this is normally done contractually (Hackett, et al., 2007). Nevertheless, projects risks could be contractual and non-contractual (Sharma, 2006).

4.3.1 RISK ALLOCATION

It fundamentally known that the client and/or their agents allocate risk on a project because they make the fundamental decisions that impact on risk such as procurement method; form and type of contract to use (Hackett, et al., 2007). See table 7 for risk allocation consideration factors used by consultants in the Zambian Building Sector. Consultants were asked to illustrate which consideration is used when allocating risk using a scale of 1-5, where 5 was exceptionally considered and 1 never considered. A mean score was calculated to determine which of the considerations were prioritised. The decision rule was that any consideration with a mean of above 3.34 is prioritised as a selection factor as this was the average mean score for the sample.

<table>
<thead>
<tr>
<th>Consideration</th>
<th>Mean Statistic</th>
<th>Std. Deviation Statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foreseeability of risk by party</td>
<td>3.17</td>
<td>0.85</td>
</tr>
<tr>
<td>Clients preference</td>
<td>3.23</td>
<td>1.03</td>
</tr>
<tr>
<td>Ability to sustain the consequence</td>
<td>3.31</td>
<td>0.97</td>
</tr>
<tr>
<td>When risk occurs risk is on the party</td>
<td>3.35</td>
<td>1.01</td>
</tr>
<tr>
<td>Ability to control risk</td>
<td>3.44</td>
<td>0.88</td>
</tr>
<tr>
<td>Understanding of risk</td>
<td>3.48</td>
<td>0.99</td>
</tr>
</tbody>
</table>
Prioritized selection factors for risk allocation include; understanding of risk, ability to control risk and when the risks occur; risk is on the party. It is surprising that ability to sustain consequence is not a prioritised consideration. This also implies that risk analysis is not given the importance it requires as this is where consequences for risks are considered. There is a need for consultants to consider the consequences of risk if ample consideration is to be given to risks that have dire consequences.

4.4.2 RISK RESPONSE

Various response measures are used by contractors to respond to risk. Significant methods for risk response used in the building sector include; percentages added to unit rates, sub-contractors, claims and insurance to respond to risk (see table 8).

<table>
<thead>
<tr>
<th>Response measure</th>
<th>Mean</th>
<th>Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abandon site</td>
<td>1.30</td>
<td>0.65</td>
</tr>
<tr>
<td>Slow down progress on site</td>
<td>2.33</td>
<td>1.06</td>
</tr>
<tr>
<td>Premium added to preliminaries</td>
<td>2.52</td>
<td>1.38</td>
</tr>
<tr>
<td>Percentage to unit rate</td>
<td>2.70</td>
<td>1.41</td>
</tr>
<tr>
<td>Use of sub-contractors</td>
<td>2.76</td>
<td>1.13</td>
</tr>
<tr>
<td>Claim</td>
<td>2.99</td>
<td>1.18</td>
</tr>
<tr>
<td>Provision of insurance</td>
<td>3.43</td>
<td>1.15</td>
</tr>
</tbody>
</table>

The aforementioned were decided upon after calculating the average mean which was found to be 2.58. Any measure with a mean above 2.58 was considered to be a significant response measure as shown in table below. However, this does not mean that other measures are not important it just implies that most risks encountered use the mentioned risk response measures. From the findings of Kaliba, et al. (2013) and Auditor general’s report (2012) risks factors cause delays, cost overruns and quality shortfalls. This could be an indication that the risk response measures are inadequate implying that more measures have to be put in place to mitigate risks. the semi-structured interviews pointed out that the most utilised risk allocation methods in the building sector are risk transfer (insurance, bonds and guarantee, and transfer through contract by modification of clauses) and acceptance (contingency sum and float). In view of the sectors current performance this criterion might need to use other methods of allocation such as risk sharing and/or additional measures to achieve desired project delivery outcomes of quality, schedule and cost within estimated budget.
RISK MONITORING

Projects are monitored for various things such as cost, quality, schedule, safety compliance etc. The questionnaire survey seems to suggest that this is not an area that is adequately covered as 42.6% of consultants and contractors agree with the adequacy of monitoring while the remaining 13.9% are unsure and 43.6% seem to point out that they disagree with the adequacy of monitoring done. This echoes the need to monitor projects more closely by those involved. The dissatisfaction is more pronounced amongst contractors. The interviews results also re-enforced the need to monitor projects more closely by contractors and consultants as respondents were of the view that the monitoring done currently is not sufficient. This therefore calls for more supervision, tests and inspection of works on building projects.

RISK COMMUNICATION

Feedback was used as a proxy for communication. Feedback is given on progress and performance related issues such as quality, payment, project schedule as per information from the semi-structured interviews. This is congruent with the questionnaire survey results as 75.5% of respondents indicated that feedback is given. However 5% were unsure about the adequacy of the feedback while 6.5% felt it was not adequate. However, the semi-structured interviews provided evidence that even though feedback is given, it is not timely leading to delay on queries for omissions, errors and additional information. Additionally, there seem to be various methods of communication used such as phoning, meetings and letters.

5. CONCLUSION

Risk management in the Zambian building sector is not formalised and is unsystematic. The most utilised method is the risk identification while risk analysis and risk monitoring are not sufficiently done. The most utilised methods of responding to risks by contractors are; insurance, percentages added to rates and on occasion projects are abandoned while the consultants as they play their agency role allocate risk mainly by risk transfer and acceptance. In their consideration for risk allocation, consequences of risk do not rank highly as a decision factor. Various suggestions have been made on how to improve risks management practice such as adoption of a formalised risk management system that is carried out in a systematic manner; use of risk identification methods that enable the identification of consequential risks; use of analysis methods that are less subjective; and lastly improved monitoring and communication on projects so as to enable players make timely and appropriate decisions on risk management. This research has identified risk management
practices as they apply to the building sector and improvements that can be adopted. There is however need to identify practices in other sectors such as roads, mechanical works etc. to be able to realise meaningful risk management in the Zambian construction industry as a whole.

8. REFERENCES


The identification of non-value adding activities on construction site in Lagos, Nigerian

Don-William Osiluamhe Imimole¹, Ruben Ndihobwayo², Eric Kwame Simpeh³
¹215180291@mycput.ac.za, ²ndihobwayor@cput.ac.za, ³simpehe@cput.ac.za
¹,²,³ Cape Peninsula University of Technology, Department of Construction Management and Quantity Surveying
¹MTech student, Tel 0219598693, Mobile 0742586291
²Lecturer, Tel 0219596845, Mobile 0737215859
³Lecturer, Tel 0219596011, Mobile 0835489732

ABSTRACT

Purpose: The purpose of this study is to identify non-value adding activities (NVAAs) associated with site management in the Nigeria construction industry in Lagos State as a case study.

Design: A qualitative approach was adopted with a purposive sampling whereby observations on construction activities on sites, self-administered open-ended interviews were conducted with consulting engineers, site engineers, site managers and construction managers.

Findings: Three construction companies took part in the survey with eight of its personnel participating in the interview. It was revealed that improper planning of construction site activities such as material management, site layout, and the competency of site personnel resulted to non-value adding activities hence this confirms the status of poor site performance in the industry.

Limitations - The study was confined to selected building construction sites in Lagos state, Nigeria. The attention was only placed on the evaluation of non-value adding activity (waste) associated with site management in the construction industry during project execution phase.

Practical implications - The study is carried out to help in making suitable contributions to the understanding of NVAA management measures through the application of some important principles that has been neglected and to create awareness for construction company workers to
ascertain factors that contribute to NVAAs so that they can reduce the level of waste and increase productivity during construction.

**Keywords:** Construction industry, management measures, Nigeria, Non-value adding activities (NVAAs), site management, waste

1. **INTRODUCTION**

The performance of the construction industries on projects in developing countries, including Nigeria, is poor in most aspects including cost, quality and productivity (Ofori, 2012:7). A major factor contributing to this impediment is non-value-adding activities (NVAAs). Non-value-adding activities known as waste affect project in negative ways. Performance has been a challenging issue in construction process for quite some time. The construction industry is mainly project based and various complexities are inherent in the construction projects. The construction process involves mainly dealing with diverse interests of multiple stakeholders and resultant changes. These changes (variations) are considered as non-value adding endemic symptoms that seriously affects the performance and productivity aspects in construction projects (Ralph & Iyagba, 2012: 467).

According to Koskela (1992:17) non-value adding activity (waste) can be defined as activity that takes time, resources or space but does not add value. Relating this definition to the context of this study, NVAAs are irrelevant efforts that consumes time and resources without adding value directly or indirectly to project requirement during construction (Koskela, 1992:17).

NVAAs include work not done, rework, unnecessary work, errors, stoppages, waste of materials, and deterioration of materials on site (Alarcon, 1997:376). These NVAAs may arise as a result of defect, overproduction, unnecessary processing, unnecessary material movement, unnecessary movement of people, waiting time, inventories, design changes, lack of trade’s skill, slow decision-making, poor coordination among team members, poor planning and scheduling, material delivery delay, poor construction methods, poor documentation on site, slow revision of drawings, poorly stated site design information and uncertainty in weather conditions (Alwi, 2002: 19).

These causes can thus be classified with respect to documentation and design, handling of materials, procurement of materials, professional management, and physical factors (Alwi, 2002:22). It is widely known that if these NVAAs are left without suitable control measures put in place they can be in contradiction with the organisation in the construction industry in terms of competitiveness (Alwi, 2002:20; Koskenvesa, 2010:482). Hence this study will be limited to site management taking cognizance of material management, site layout and the competency of site personnel, the higher the knowledge and awareness of non-value adding activities associated with site management, the greater the prospect of avoiding them and
consequently help in the reduction of construction delivery cost. With this in mind the aim of the study is to identify non-value adding activities associated with site management and examine the efficiency of mitigation measures used to minimise the occurrence NVAAs in the Nigeria construction industry.

2. THE NIGERIA CONSTRUCTION INDUSTRY

The construction industry is considered by economists as a leading driver of economic development in a country, this is due to the fact that almost all other sectors of the economy in one way or another depend solely on the products and services of the construction industry in order to carry out their operations. For example, it would be impossible for the manufacturing industry to thrive without appropriate buildings and infrastructure such as manufacturing plants, roads linking raw materials and manufacturing plants, office buildings, etc., all products of the construction industry (Dantata, 2008:31). It would be impracticable for any industry to function without any infrastructure in place or if there are no access or link roads for the transportation of raw materials or if there are no office building or other construction outputs. That means the construction industry plays an important role in the economy, and there is hope for the Nigerian construction industry in the coming years, with emphasis shifting to infrastructure growth. Nigeria construction industry has suffered many setbacks in term of completion of the project at stipulated period within the predetermined sum, some of the construction project in Nigeria experience time and cost overrun which in turn lead to the abandonment of project (Mohammed, 2012: 786).

As in all other countries, several entities are active within the construction industry in Nigeria. These include the clients, architectural and engineering firms, general contractors and subcontractors, management and engineering consultants, labour unions, equipment and materials suppliers, financial bodies, and the government (Dantata, 2008: 35).

3. EXAMINING THE CONCEPT OF NON-VALUE ADDING ACTIVITY

The term “non-value adding activity” is widely used by researchers in literature relating to lean production (Koskela, 1992: 17). Non-value adding activity is used to distinguish between physical construction waste on site and other waste which occurs during the process of construction. Alarcon (1994:378) and Koskela (1992:17) argue that all those activities that produce cost direct or indirect, and take time, resources or require storage but do not add value or progress to the product are called non value-adding activities or waste. Waste in the construction industry has been the
subject of several research projects around the world in recent years, some of them have focused on the environmental damage that results from the generation of material waste (Formoso & Hirota, 1999:326). However, Serpell (1995:69) contends that construction managers do not know of, or recognise the factors that produce waste, nor do they have measurements of their own performance because most of the factors are not observable. Hence, the identification of these factors that cause waste and a measurement of their level of importance, would provide useful information that would allow management to actively reduce their negative effects in advance (Serpell & Venturi, 1995:69).

According to Formoso (1999:328), waste is any losses produced by activities that generate direct or indirect costs but do not add any value to the product from the point of view of the client. Waste in construction is not only focused on the quality of waste of materials on-site, but also related to several activities such as overproduction, waiting time, material handling, processing, inventories, movement of workers and waste of any nature different from the previous ones, such as burglary, vandalism, inclement weather, accidents, etc. (Formoso & Hirota, 1999:329). According to Mohanty and Deshmukh (1999:165), any resources deployed in the work process which do not create utility for the stakeholders can be regarded as waste. Consolidating research from authors such as Alarcon (1995:401), Koskela (1992:47) and Lee (1999:64) reveal the main categories of waste during the construction process described as follows: rework/repairs, defects, material waste, delays, waiting, poor material allocation, unnecessary material handling and material waste. Chilean building construction project experience waste variables such as waiting time, idle time and traveling time (Serpell & Venturi, 1995:11). The Nigeria construction industry has a similar productivity problems as Indonesia (Kaming, 1997:83). Mohamed and Ticker (1996:379) investigation showed that 25% time savings is achievable in a typical construction work package without increasing allocated resources these findings are mainly associated with time waste on construction sites.

4. THE CAUSES OF NON-VALUE ADDING ACTIVITIES IN CONSTRUCTION INDUSTRY

According to Han (2007:2083) errors and changes generally triggers NVAAs in the construction industry in the form of interruption, productivity loss, and rework, which needs additional time and efforts in order to compensate for the loss of time and effort. Although NVAAs can be identified and quantified by the use of simulated model, they can also be easily propagated into other related activities (Han, 2007:2088). Hence, rework in form of the rework cycle that may arise either at the design stage or on construction sites spreads through the construction process regardless of project activities, types and/or location (Cooper, 2002:215).
Hwang (2009:197) further identified ‘design error’ to be the root cause of rework among other sources such as owner change, design change, constructor error/omission, constructor change, vendor error/omission, vendor change, and transportation error, on both owner and contractor report projects on the database of construction industry institute (CII) in the USA (Hwang, 2009:197). Alwi’s (2002:9) study that focused on the construction in Australia and Indonesia came up with a decision that design changes, lack of trade’s skill, slow decision-making, poor coordination between project partners, poor planning and scheduling delay in material delivery to site, inappropriate construction method, poor design, poor quality of site documentation, slow drawing revisions and distributions unclear site drawings, unclear specification, and weather conditions, individual and collectively result in NVAAs in varying degrees. According to Alwi (2002:7) the sources of NVAAs can be categorised in terms of professional management, people, design and documentation, material, physical factors and site operation. According to Nazech (2008:4) the causes of NVAAs (waste) can be divided into 6 groups these include:

- Manpower, caused by: unskilled labours, lack of proper supervision, sub-standard subcontractor personnel, and inexperience field supervisors.
- Professional management, caused by: poor planning, poor information distribution/channelling, lack of coordination among construction stakeholders.
- Design and Documentation, caused by: site documentation system not well integrated, unclear specifications, low quality drawings, delay in revision and redistribution of construction drawings, design changes, and low quality design.
- Materials, caused by: low quality materials, delivery of materials that not according to schedule, material handling/storage on site, and inappropriate use of materials.
- Work execution, caused by: incorrect construction method, lack of construction equipment, incorrect selection of equipment, unsuitable equipment, and poor site layout.
- External factors, caused by among others: site condition, weather, and damage caused by third part.

5. METHODOLOGY

The purpose of this study is to identify non-value adding activities associated with site management in the Nigerian, building construction industry using 3 building construction companies in Lagos State, as a case study. The purpose for picking Lagos state as a case study is because of
the huge nature of building projects which have been carried out on a regular basis. Purposive sampling method was used to select participant companies because it was assumed their construction sites would reveal the matter under investigation. A mixed method approach consisting of semi-structured interviews and field observation was taken into consideration for a number of reasons. The first reason is to be able to achieve the logic of triangulation (Krause & Denzin, 1989:13) since no method (e.g. questionnaire, interviewing or documentary analysis) can completely capture all the relevant features of the study. Hence, the combination of methods allows a proper crosscheck of data gathered by different methods, thus making the result of the study credible and valid. According to Bryman (2004:131), combining different methodologies in a single study enhances the researchers claim for the validity of their conclusions if they can be shown to provide mutual confirmation (Bryman, 2004:131).

A semi-structured interview was therefore conducted among major project stakeholders in the Lagos state building construction sector including project managers, site managers and construction managers. The questions that were asked were derived from the reviewed NVAAs related literatures.
A number of 8 site personnel were interviewed and constituted the sample size for the study. The interview was self-administered using pre-designed questions, and a voice recorder. Questions where structured into four sections focusing on what are the causes of NVAAs, the impact of NVAAs, and measures for minimisation of the occurrence of NVAAs, and quality management issues. Each interview lasted for at least 45 minutes, and as discussions took place, physical observations were done whenever needed for better clarifications. Observation was done on site layout, material stacking and pictures were taken with a digital camera.

6. FINDINGS

6.1 Description of sites visited and interviewees
Three various types of companies’ ownership are private companies located in Lekki-Aja area in Lagos state. Company A was a building construction company involved in property development, management, building and selling. Company A specialises in developing innovative and unparalleled luxury apartments, duplexes, detached homes and commercial outlets. Company B also was a private building construction company specialising in building of structures, and Company C also specialises in building construction.

Questions were administered directly to eight individuals in the form of interviews and their positions are as follows:
Table 1: Position and experience of interviewees
The highest work experience of respondents in the construction industry was 16 and the least work experience was 7 years. This indicates a reasonably high work experience profile of respondents. The respondents were involved in the daily activities as they worked either as project managers, site managers and construction managers.

6.2 Observation of the existence of NVAAs on site

The observation during a visit to three construction sites of three different companies as shown in Picture 1, Pictures 2, and Picture 3 respectively revealed a lot of activities that added no value during the construction process. Hence, this resulted in creating a lot of wastages such as time and money.

Pilling up of materials at the same time and same places was also one of the observations and this showed that there was a problem not only with the site plan but also the program of work.

Picture 1, reveals that scaffolding materials, bricks and sharp sand where all piled up alongside waste materials left uncleand this will lead to materials mixing up and to separate the good ones from the used ones becomes a problem. Attempt to rectify this will lead to time wastage and labour of which if this was considered from the early stage the problem would have been avoided.

Picture 2, shows stalkung of bricks on the main road leading to the building and also reinforcement bars were seen laying on the floor and an excavating machine abandoned at the same working space. The machine
from site observation was rented by the contractor but with the materials pilled on its way it can’t move until the materials are used up or cleared that is an extra cost because there is a time frame for the machine to be used. All this contributes to waste and thus lead to NVAA.

Picture 3, also shows the same abnormal way of pilling up materials and this goes a long way in affecting the site plan because it distorts movement of man, equipment and materials and constitute NVAA.

6.3 Results from interview for identification of the existence of NVAA during construction operations

6.3.1 Causes of NVAA in building operations

6.3.1.1 Repair on finishing works
Interviewees indicated that repairs on finishing works were one of the important issues contributing to NVAA in the companies surveyed. Repair is defined as an activity that must be redone or altered and it is caused by the design error (Nagapan & Zin, 2012: 26). This is a fact because rework is a waste, due to design error, omissions, changes and mistakes. Repairs include variations and it can occur any time and within any activity during construction. In this case repairs of finishing works include casting work, tile works, ceiling works, painting, brickwork and plastering. Two of the site managers interviewed were of the opinion that repairs on finishing works are common cause of NVAA. The interviewees stressed on the fact that certain construction activities require specific tools that need higher skilled labour force and experience in order to fulfil the clients finishing requirement. One of the site manager who has been in the field for 12 years stated that the occurrence of repair on finishing works is not only a result of lack of labour skills and poor quality of materials used, but also due to the failure of other construction works such as mechanical, electrical and structural work.

6.3.1.2 Waiting for materials by site managers
Materials represent a large proportion of construction costs and continue to represent a large portion in future. However, interviewed indicated that few material management systems are presently effective in the construction industry. Material acquisition in construction includes material inspection, delivery, handling, and storage before installation. A lack of material management in the construction industry in general, results to waiting for material on-site. Interviewees indicated that waiting for materials consisted not only of waiting for material deliveries to site by external deliveries, but also waiting for material deliveries from storage on site to certain areas of the construction site (internal delivery). From the site managers point of view, in order to minimise the waiting time of materials during the
construction process (internal and external) site layout is of essence importance and should be designed properly to ensure a proper flow of material without any form of interruptions. Also efficient communication link must be established with suppliers. The suppliers must know and monitor each stage of work-in-progress. And this can best be achieved if contractors give authorities to their site management to communicate directly with suppliers on site with regards to materials needed.

6.3.1.3 Delays to schedule
Interviewees revealed that a large number of reasons usually cause delays such as inclement weather, lack of trade skill, poor planning and scheduling, delay of material delivery to site, design changes, and slow decision making. Respondents from the different companies were of the opinion that delays to schedule was one of the most important variables affecting construction projects, hence contributing to non-value-adding activities on site.

6.3.1.4 Design Changes
Choy and Sidwell (1991:25) describe design changes as any change to the scope of the work as defined by the contract documents following the creation of legal relations between the principal and contractor. Often the changes are no fault of the contractors. Design changes may occur in architectural, structural, plumbing and drainage, site works or other aspect of construction. Interviewees confirmed that design changes usually are the result of owners’ demand or clients request for changes to design in order to meet changing requirements and preferences. Also design changes are caused by problems in material acquisition, and unforeseen circumstances.

6.3.1.5 Slow decision making by the site managers
Decision-making is a key aspect when carrying out duties during construction. A good decision is often the result of much careful information gathering and analysis, involving discussions with a wide range of people, scrutiny of recorded information, and for some, decisions and manipulation of data using computer programs. A decision involves choosing between several courses of action. If the choices are well-defined, the decision problem can become a regular course. If the choices are unclear, the problem is non-routine and the site managers may spend large amount of time looking at options before reaching a final decision. Slow decision-making can be caused by contractor’s personnel, clients, or consultants. From the site manager’s opinion, slow decision making on the part of clients leads to delays in schedule. Therefore, to avoid delays in the construction process, contractors have to be proactive when communicating with owner representatives and workers on site.
6.3.1.6 Lack of trades' skill- Human beings are the most important form of resource in completing construction projects. This category of "people" relates to the skill of the tradesmen/labourers, its distribution on site, the effectiveness of supervisors/inspectors on site. The performance of field labour is critical to the success of any construction project. According to the site manager and site engineers, lack of trade skills is still a managerial problem to contractors to complete a project satisfactorily. In fact, observations proved that "skilled" operators were often not skilful, having gained their experience on the job site, learning construction skills through trial and error. The trend observed with activities on the project was that, labourers do not use their own initiative, and instead rely on both the foremen and the supervisors' ability to check and approve all works. For many activities, labourers are unable to interpret site drawings and thus rely on instruction from foremen or supervisors. As a result of this, site managers have developed their own formal "in-house" training and evaluation programs. Labour as a resource has specific characteristics. The production output of labour is a function of skill and motivation. From interviews it was clear that building construction companies in Nigeria has similar problems to other developing countries that is poor labour productivity.

6.3.2 Causes of NVAAs from limitation of construction personnel

6.3.2.1 Site management and supervision
Poor site management and supervision was observed to be a major factor causing construction waste on the site visited, pilot study conducted on the three sites showed that a considerable amount of construction waste is mostly due to improper management and supervision of sites that is why used and unused materials can be stalked abnormally without consideration.

6.3.2.2 Lack of experience
Lack of experience was one of key causes of construction waste. Interviewees indicated that most of the contract labour had little or no experience in construction. Thus, inexperienced foremen contribute to more defective works and reworks in Nigeria construction industry and this is all as a result of inexperience field supervisor.

6.3.2.3 Inadequate planning and scheduling
Poor planning and scheduling were identified as one factor that causes waste. Interviewees revealed that improper planning was one of the most significant contributors to waste generation, since this lead to the interruption of the flow of material supply and rework to the building (indirect waste).
6.3.2.4 Mistakes during construction
Mistakes during construction were also pointed out to be another factor causing construction waste. This factor due to human limitations results in defaulting from construction processes. This factor also often leads to the construction waste thereby leading to demolishing and rebuilding so as to effect the necessary correction; hence this ends up in wasting materials, time and labour.

6.3.3 Impact of NVAAs
From the interviews, it was indicated that NVAAs have a detrimental effect on construction projects in different forms. Rework was viewed as a contributor to most cost increase in construction projects. Overtime that seems to be a standard rather than the exception in the construction industry negatively impacts productivity and increases fatigue and accident that eventually increases the cost and time spent on construction projects (Hanna, 2005:734). From the interviews it was obvious that if these NVAAs are left unchecked, it will have severe consequences for the competitiveness of organisations and by extension, the productivity of the industry.

6.3.4 Measures for minimisation of the occurrence of NVAAs
Managing and monitoring the different waste streams on a construction site requires a detailed waste minimisation strategy. This needs careful planning throughout the design, build and occupancy phases, to ensure its success, effectiveness and compliance with building regulations. Interviewees pointed out some mechanisms in place for the minimization of the occurrence of waste and these are reduce, reuse, and recycle. However, from the researchers’ observation on site, there was no evidence that these mechanisms were adopted. Waste prevention is the ideal, and this can be addressed first by identifying possible waste streams early on in the build process, and then designing for their minimisation. Better communication between building professionals to ensure exact calculations of required materials are made can mean that this waste is prevented. Once waste has been produced, the best method of managing it is through reuse either on the existing site, or a nearby site. Many materials can be usefully reclaimed, and even sold to offset the costs of a building project. Recycling materials is the final option for managing waste. Materials that can be reused or recycled need to be identified early on the build process, and segregated for easy storage, collection and transfer.

6.3.5 Quality management issues
As defined by Zairi (Zairi, 1991: 41), quality management is: “that aspect of the overall management function that determines and implements the quality policy and as such, is the responsibility of the top management”. Quality management refers to all activities of the overall management
function that determine the quality policy, objectives and responsibilities, and the implementation of these by means such as quality planning, quality control, quality assurance and quality improvement within the quality system. From the survey carried out, interviewees pointed out that there are techniques for quality control among which are; education and training, testing and measurement of work done, improved craftsmanship, improved employee-management relationship, and stronger prequalification criteria. While it was evident interviewee were aware of quality improvement measures, the implementation is still problematic and this effect site operation performance. Love and Li (2000: 489) state that if the construction industry is to improve its performance, all organisations involved in the project supply chain should implement quality management practices.

7. CONCLUSIONS

From the findings of this study, management of project is centered on the competence of key project stakeholders in the construction sector, the project sector client should ensure the promotion of assignment of construction project management responsibilities to appropriately skilled internal experts in order to forestall clients, induced NVAAs. It can also be suggested that consultants should avoid the use of graduates without necessary knowledge to sign-off work on project performance. Contractors also should place emphasis on professional development of their existing employees and also that new recruits are armed with appropriate built environment qualifications so that, they can be sure of their suitability for challenging roles in the industry, especially the ability to identify the root of NVAAs during construction process.

An issue of concern is that of time overruns, which in turn may be influenced by the impact of NVAAs on project time as indicated in the survey, and other previous research findings documented in the construction management literature. Further, based on the perceptions of the survey respondents and previous authors, detrimental effects of notable NVAAs such as inadequate supervision, rework relative to design, and lack of required competencies should be addressed in order to ensure improved project performance in the industry. These suggestions originated based on the evidence that the lack of appropriate artisan and site management skills could increase the amount of NVAAs, which in turn, add to poor performances recorded in Nigeria construction industry.

8. RECOMMENDATIONS
The identification of the causes of non-value adding activities at an early stage would provide useful information that would allow project members to reduce its occurrence. Workshops for project team members on lean design management approach needs to be conducted regularly. By adopting effective implementation of appropriate methodology of lean construction principles at an early stage of the construction project, non-value adding activities can be minimized. Understanding the penalties of non-value adding activities all participants will be able to execute their roles as facilitators of a concise, clear and comprehensive process, hence ensuring the elimination of non-value adding activities.

Further research should focus on the holistic barriers of the awareness of NVAAs and developing of a universal implementation framework that can fit into any construction environment. Additional research should be made in the adoption of other Lean construction tools and techniques within Nigeria construction industry. While further research should be developed to address the research limitations highlighted in this thesis.

In spite of the fact that the framework developed in this research facilitates the identification of NVAAs in Nigeria construction industry, a tool kit and implementation guide should be developed to further help in the limitation of NVAAs created on site.

9. REFERENCES


The predominant causes of construction delays – a literature review

Martinus Johannes Maritz
martins.martizs@up.ac.za
University of Pretoria, Department of Construction Economics, Pretoria, 0002, South Africa.
Tel: +27 12 420 2581, Mobile: +27 83 273 3055

Hendrik Frederik Prinsloo
hendrik.prinsloo@up.ac.za
University of Pretoria, Department of Construction Economics, Pretoria, 0002, South Africa.
Tel: +27 12 420 2584, Mobile: +27 79 878 3628

ABSTRACT

Purpose of this paper
The main purpose of the paper is to establish whether there is a level of commonality in the main causes of construction delays internationally.

Methodology
The objectives of the paper were achieved through utilisation of a qualitative approach by means of an in-depth literature review. The literature review provided the main causes for construction delays applicable to each researched country.

Findings
It was evident from the review of local and international studies that delays remain very prevalent in construction projects. Variation orders were the predominant cause of client delays. Late payment of the contractor, long waiting times for the approval of drawings, slow decision-making and incomplete or poor quality drawings were also significant causes of delay. The review of the external causes of delay revealed that the shortage of construction material was the predominant cause of delay. In addition, price fluctuations, unforeseen site conditions and slow approvals by government organisations, also contributed to the prevalence of delays.

Value
The identification of common causes will be of assistance to ultimately...
address the universal problem of the late completion of construction projects.

KEYWORDS: Causes of delay, construction delays, types of delay

1 INTRODUCTION

It is often said that for a building or construction project, there are three objectives, which the owner of the project is aiming to achieve. These are: cost, quality and time. Any project faces delays and disruptions, especially with the complex projects of today, which entail many interfaces between the installations and any overlapping activities (Eizakshiri, Chan & Emsley, 2011).

Many researchers in the field of construction project management have undertaken to study the causes and effects of construction delays. Regardless of the multitude of research cases, finding the causes of such delays, and possible remedies for reducing delays in projects, the failure of many projects to finish on time remains problematic globally.

This article explores how a construction delay can be defined, the different types of delays and ultimately investigates the common reasons for delays both in Southern Africa and Internationally.

2 CONSTRUCTION DELAYS

2.1 What is a construction delay?

In the study of Assaf and Al-Hejji (2006) a construction delay is defined as “the time overrun either beyond the completion date specified in a contract, or beyond the date that the parties agreed upon for delivery of a project.”

Delay is also defined as “an act or event which extends required time to perform or complete work of the contract and manifests itself as additional days of work” (Zack, 2006) and “any occurrence that affects the contractor’s progress or makes it work less efficiently than would otherwise have been the case” (Ndekugri, Braimah & Gameson, 2008).
2.2 Types of delays

A number of studies attempted to categorise delays in terms of the impact, risk and cause of the delay. Figure 1 provides a summary of types of delays.

![Diagram of Types of Delays](image)

**Figure 1** Types of delays

The criticality of a delay can be defined as follows in terms of the ultimate impact on completion:

1) Critical delay – a delay on the critical path of the project and as a result the final completion date of the project will be delayed; and
2) Non-critical delay – a delay that is not on the critical path and would therefore not impact of the overall completion date.

(Ndekugri *et al.*, 2008)

Most contracts provide for an extension of the contract period only if a delay is deemed to be excusable (McKenzie, McKenzie & Ramsden, 2009).

A non-excusable delay is defined as a delay caused by the contractor or any aspect that is within the sphere of control of the contractor. The contractor will not be entitled for any additional time or compensation for this type of delay (Tumi, Omran & Pakir, 2009).

An excusable delay on the other hand can be described as a delay caused by either of the following two factors:

- Third parties or incidents beyond the control of the client and the contractor; and
- The client or the client’s agents.


Compensation will have to be considered if a delay is found to be excusable.
3 METHODOLOGY

A qualitative approach by means of an in-depth literature review was utilised as the primary research method. According to Leedy and Ormrod (2013) and Hofstee (2006), the literature review serves several purposes:

- It assists in addressing the research problem;
- When information is available on what others have done, the chosen problem can be investigated with deeper insight and more complete knowledge;
- It indicates that there is a theoretical basis for the research;
- It demonstrates how the research fits in with the work that has already been done;
- It demonstrates that the work should lead to the production of new knowledge.

The comprehensive literature conducted as part of the study provides an overview of the different types of delay in the context of the construction industry. The main focus, however, was a review of recent studies conducted internationally on the main causes of construction delays. The main purpose of the review of the previous studies was to establish if there is commonality in the main causes of construction delays internationally. The identification of common causes will be of assistance to ultimately address the universal problem of the late completion of construction projects.

4 CAUSES OF DELAY

Over the years, a number of studies have been conducted to identify the causes of delays in the construction industry. These studies have been conducted in different countries. This section aims to identify the international causes of delay by reviewing the relevant literature.

4.1.1 SAUDI ARABIA

Assaf, Al-Khalil and Al-Hazmi (1995) uses randomly selected samples in Saudi Arabia to identify the causes of delay in large building projects. Surveys comprising of the causes of delays were presented to the respondents requesting a ranking according to degree of importance. These surveys conducted, provided data that was analysed in terms of frequency, severity and importance of the delays. The study identified 73 causes of delays. The owners who participated in the survey alleged that the delays were as a result of the fault on the part of the contractor and the labours. However, the final results of the survey contradicted this opinion,
as it was found that the majority of the causes of delay resulted from the actions of the employer/owner and his agents/consultants.

### 4.1.2 HONG KONG

Chan and Kumaraswamy (1997) conducted a survey that was aimed at determining and evaluating the significant factors that cause delays in Hong Kong construction projects. From the survey, it was concluded that poor site management and supervision, unforeseen ground conditions, low speed of decision making involving all project teams, client-initiated variations and necessary variations of works are the five most significant sources of construction time overrun. Differing perceptions to the major causes of delays observed between Hong Kong, Saudi Arabia and Nigeria which indicate specific differences between construction industries in the different countries were further identified by Chan and Kumaraswamy (1997).

### 4.1.3 EGYPT

Amer (1994) discussed the causes that contribute to construction delays in Egypt. The study involved a comparison of delays in projects from areas close or within Egypt. The study identified 32 causes of project delays. The causes included: financing by contractor during construction; delays in contractor’s payment by owner; design changes by owner or his agent during construction process; partial payments during construction process; and non-utilization of professional construction management during the construction process.

### 4.1.4 MALAYSIA

Abdullah, Rahman and Azis (2010) conducted a survey to determine delays experience by a government agency in Malaysia, known as Majlis Amanah Rakyat (MARA). The results of the analysis revealed that the most significant delay causes were cash flow and financial difficulties faced by contractors, contractors’ poor site management and ineffective planning and scheduling by contractors.

### 4.1.5 INDONESIA

Factors influencing construction time and cost overruns on high-rise projects in Indonesia were discussed by Kaming, Olomolaiye, Holt and Harris (1997). In this study project managers were surveyed. It appeared that cost overruns occur more frequently and they are more severe compared to time overruns. The main factors that influence time delays are design changes, poor labour productivity, inadequate planning and resource shortages.
4.1.6 TURKEY

The Turkish construction industry was studied by Kazaz, Ulubeyli and Tuncbilekli (2012) and causes of time extensions and their level of importance in Turkey were identified. According to the results obtained, design and material changes was determined as the most important factor, followed by the delay of payments, cash flow problems, contractor’s financial problems and poor labour productivity.

4.1.7 THAILAND

Ogunlana, Promkuntong and Jearkjirm (1996) conducted a survey to investigate delays experienced in high-rise building projects in Bangkok, Thailand. Similarly, to other developing countries the following factors resulted in delays: lack of finance, technically incompetence and less experienced local companies, underdeveloped business environment, complexities in legal and regulatory systems and distinct socio-cultural issues.

4.1.8 INDIA

According to Iyer et al. (2008) the increase in size and complexity of the construction projects in India resulted in a higher number of claims and disputes. The following reasons for delay were identified: late handing over of site, late receipt of drawing, accidents, temporary stoppage, reworks and extra work.

4.1.9 JORDAN

Al-Momani (2000) undertook a study to determine the causes of delays on 130 public projects in Jordan. Residential, administration buildings, school buildings, medical centres and commotion facilities were among the projects evaluated. The findings of the study identified the following reasons for delays: user changes, weather, site conditions, late deliveries, economic conditions and increase in quantity.

4.1.10 NIGERIA

A study was conducted by (Aiyetan, 2014) in the south western part of Nigeria to determine the causes of rework and consequential delays in construction projects. Descriptive and quantitative research methodologies were utilised. To collect comprehensive data for analysis, a survey and historical data were utilised. The results of the study identified the following causes of delay: rework which results in consequently delays in the
construction schedule; inferior quality of concrete; poor plastering and construction errors during excavation (Aiyetan, 2014).

4.1.11 DELAYS IN SOUTHERN AFRICA

Baloyi and Bekker (2011) investigated the causes of cost overruns and time delays during the construction and upgrading of the ten 2010 world cup stadia in South Africa. Design-related factors were found to cause the most delays in the construction of the stadia.

Musuya (2012) undertook a study in Botswana to determine the impact of delays and the inexcusable reasons of delays in construction projects by either citizens or non-citizen construction firms. The results of the study outlined that a large portion of the public sector in Botswana encounters delays. The results of the analysis/study, identified management style as the main factor of delay in the construction industry of Botswana (Musuya, 2012).

Klopper and Brümmer (2000) conducted a study to determine the impact of delays on building projects in South Africa. 211 public sector construction projects were reviewed. Insufficient work-rate was determined to be main factor that has influence the late completion of building projects in South Africa (Klopper & Brümmer, 2000).

5 SUMMARY OF FINDINGS

Poor site management and supervision were the main cause of delay of contractor delays – with an occurrence level 42%. Financial difficulties experience by the contractor was also a significant cause of delay with an occurrence level 33%. Please refer to table 1 for further detail

Table 1 Summary for Contractor Delays

<table>
<thead>
<tr>
<th>Reasons for delay</th>
<th>Saudi Arabia</th>
<th>Nigeria</th>
<th>Hong Kong</th>
<th>Egypt</th>
<th>Indonesia</th>
<th>Turkey</th>
<th>Thailand</th>
<th>South Africa</th>
<th>Botswana</th>
<th>Malaysia</th>
<th>India</th>
<th>Jordan</th>
<th>Occurrence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contractor:</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td>25%</td>
</tr>
<tr>
<td>Labour shortage</td>
<td>✓</td>
<td>✓</td>
<td>x</td>
<td>x</td>
<td>✓</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>42%</td>
</tr>
<tr>
<td>Site management and supervisions</td>
<td>x</td>
<td>✓</td>
<td>✓</td>
<td>x</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>x</td>
<td>✓</td>
<td>8%</td>
</tr>
<tr>
<td>Accidents</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>✓</td>
<td>x</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td>8%</td>
</tr>
<tr>
<td>Reworks</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>✓</td>
<td>x</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td>8%</td>
</tr>
</tbody>
</table>
Variation orders were the predominant cause of client delays – with an occurrence level of approximately 58%. Late payment of the contractor, long waiting times for the approval of drawings, slow decision-making and incomplete or poor quality drawings were also significant causes of delay with an occurrence level of approximately 17%. Inaccurate estimates, late site handover, poor co-ordination and inadequate supervision by the design team impacted on progress to a lesser extent, with an occurrence level of approximately 8%. Refer to table 2 for further detail.

Table 2 Summary for Client Delays

<table>
<thead>
<tr>
<th>Reasons for delay</th>
<th>Saudi Arabia</th>
<th>Nigeria</th>
<th>Hong Kong</th>
<th>Egypt</th>
<th>Indonesia</th>
<th>Turkey</th>
<th>Thailand</th>
<th>South Africa</th>
<th>Botswana</th>
<th>Mozambique</th>
<th>India</th>
<th>Jordan</th>
<th>Occurrence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Client:</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Late payment of contractor</td>
<td>x ✓ x ✓ x ✓</td>
<td>x ✓ x x x ✓ x x ✓ x ✓ x</td>
<td>x ✓ x x x ✓ x x</td>
<td>x ✓ x x x ✓ x x x x x</td>
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<td>x ✓ x x x ✓ x x x x x</td>
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<tr>
<td>Inaccurate estimates</td>
<td>x ✓ x x x x x x x x x x x x</td>
<td>x ✓ x x x x x x x x x x x</td>
<td>x ✓ x x x x x x x x x x</td>
<td>x ✓ x x x x x x x x x x</td>
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<td>x ✓ x x x x x x x x x x</td>
<td>x ✓ x x x x x x x x x x</td>
</tr>
<tr>
<td>Variation orders</td>
<td>x ✓ x x x x x x x x x x x x</td>
<td>x ✓ x x x x x x x x x x x</td>
<td>x ✓ x x x x x x x x x x</td>
<td>x ✓ x x x x x x x x x x</td>
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<td>x ✓ x x x x x x x x x x</td>
<td>x ✓ x x x x x x x x x x</td>
</tr>
<tr>
<td>Delays in design information</td>
<td>x ✓ x x x x x x x x x x x x</td>
<td>x ✓ x x x x x x x x x x x</td>
<td>x ✓ x x x x x x x x x x</td>
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<td>x ✓ x x x x x x x x x x</td>
<td>x ✓ x x x x x x x x x x</td>
</tr>
<tr>
<td>Late approval of drawings/samples</td>
<td>x ✓ x x x x x x x x x x x x</td>
<td>x ✓ x x x x x x x x x x x</td>
<td>x ✓ x x x x x x x x x x</td>
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<td>x ✓ x x x x x x x x x x</td>
<td>x ✓ x x x x x x x x x x</td>
</tr>
<tr>
<td>Inadequate design team</td>
<td>x ✓ x x x x x x x x x x x x</td>
<td>x ✓ x x x x x x x x x x x</td>
<td>x ✓ x x x x x x x x x x</td>
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<td>x ✓ x x x x x x x x x x</td>
<td>x ✓ x x x x x x x x x x</td>
<td>x ✓ x x x x x x x x x x</td>
</tr>
<tr>
<td>Slow information flow</td>
<td>x ✓ x x x x x x x x x x x x</td>
<td>x ✓ x x x x x x x x x x x</td>
<td>x ✓ x x x x x x x x x x</td>
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<td>x ✓ x x x x x x x x x x</td>
</tr>
</tbody>
</table>

Variation orders were the predominant cause of client delays – with an occurrence level of approximately 58%. Late payment of the contractor, long waiting times for the approval of drawings, slow decision-making and incomplete or poor quality drawings were also significant causes of delay with an occurrence level of approximately 17%. Inaccurate estimates, late site handover, poor co-ordination and inadequate supervision by the design team impacted on progress to a lesser extent, with an occurrence level of approximately 8%. Refer to table 2 for further detail.
Late site hand over  x x x x x x x x x x x x 8%
Design quality  x √ √ x x x x x x x x x 33%
Deficiencies in coordination  x x x x x x x x 8%
Design team supervision  x √ x x x x x x x x x x 8%
Communication client & consultant  x x √ x x x x x x x x x 8%
Slow decision-making  x x √ x x x x x x x x 8%
Unrealistic contract durations  x x √ x x x x x x x x x 8%
Inappropriate organisational structure  x x √ x x x x x x x x 17%

The review of the external causes of delay revealed that the shortage of construction material was the predominant cause of delay – with an occurrence level of approximately 25%. In addition, price fluctuations, unforeseen site conditions and slow approvals by government organisations, also contributed to the prevalence of delays, with an occurrence level of approximately 17%. Force majeure, labour disputes, inclement weather, confined site conditions and general disputes had a lesser impact, with an occurrence level of approximately 8%. Refer to table 3 for further detail.

Table 3 Summary of External Delays

<table>
<thead>
<tr>
<th>Reasons for delay</th>
<th>Saudi Arabia</th>
<th>Nigeria</th>
<th>Hong Kong</th>
<th>Egypt</th>
<th>Indonesia</th>
<th>Turkey</th>
<th>Thailand</th>
<th>South Africa</th>
<th>Botswana</th>
<th>Mozambique</th>
<th>India</th>
<th>Jordan</th>
<th>Occurrence (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>External:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shortage of construction materials</td>
<td>x √</td>
<td>x √</td>
<td>x x x x</td>
<td>x x</td>
<td>x x x x</td>
<td>x x x</td>
<td>x x x x</td>
<td>x x x x</td>
<td>x x x x</td>
<td>x x x x x</td>
<td>25%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Price fluctuations</td>
<td>x √</td>
<td>x √</td>
<td>x x x x</td>
<td>x x</td>
<td>x x x x</td>
<td>x x x</td>
<td>x x x x</td>
<td>x x x x</td>
<td>x x x x</td>
<td>x x x x x</td>
<td>17%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unforeseen site conditions</td>
<td>x x √</td>
<td>x x x x</td>
<td>x x x x</td>
<td>x x</td>
<td>x x x x</td>
<td>x x x</td>
<td>x x x x</td>
<td>x x x x</td>
<td>x x x x</td>
<td>x x x x x</td>
<td>17%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Disputes/conflicts</td>
<td>x x √</td>
<td>x x x x</td>
<td>x x x x</td>
<td>x x</td>
<td>x x x x</td>
<td>x x x</td>
<td>x x x x</td>
<td>x x x x</td>
<td>x x x x</td>
<td>x x x x x</td>
<td>8%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Economic conditions</td>
<td>x x x x x x</td>
<td>x x x x</td>
<td>x x x x</td>
<td>x x</td>
<td>x x x x</td>
<td>x x x</td>
<td>x x x x</td>
<td>x x x x</td>
<td>x x x x</td>
<td>x x x x x</td>
<td>8%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Confined site</td>
<td>x x x x x x</td>
<td>x x x x</td>
<td>x x x x</td>
<td>x x</td>
<td>x x x x</td>
<td>x x x</td>
<td>x x x x</td>
<td>x x x x</td>
<td>x x x x</td>
<td>x x x x x</td>
<td>8%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Neighbours</td>
<td>x x x x x x</td>
<td>x x x x</td>
<td>x x x x</td>
<td>x x</td>
<td>x x x x</td>
<td>x x x</td>
<td>x x x x</td>
<td>x x x x</td>
<td>x x x x</td>
<td>x x x x x</td>
<td>8%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Slow permits by govt. Agencies</td>
<td>x √</td>
<td>x x x x</td>
<td>x x x x</td>
<td>x x</td>
<td>x x x x</td>
<td>x x x</td>
<td>x x x x</td>
<td>x x x x</td>
<td>x x x x</td>
<td>x x x x x</td>
<td>17%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Government regulations</td>
<td>x √</td>
<td>x x x x</td>
<td>x x x x</td>
<td>x x</td>
<td>x x x x</td>
<td>x x x</td>
<td>x x x x</td>
<td>x x x x</td>
<td>x x x x</td>
<td>x x x x x</td>
<td>8%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inclement weather</td>
<td>✓</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>✓</td>
<td>17%</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acts of God</td>
<td>x</td>
<td>✓</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>8%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Labour dispute and strikes</td>
<td>x</td>
<td>✓</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>8%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Civil disturbances</td>
<td>x</td>
<td>✓</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>8%</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Increase material cost</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>✓</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>8%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>External factor-related</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>✓</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>8%</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

6 CONCLUSION

It is evident that there is a high degree commonality in construction delays internationally. A good strategy to try and minimise delays would be to focus to address the most prevalent delays first.

7 REFERENCES


Zack, J. 2006. Delay and delay analysis: Isn't it simple?
A field study investigating the role of Environmental Ethics to enhance Architecture Design Firm’s competitiveness through delivering sustainable designs

Ayman A. E. Othman ¹ and Noha A. Shaheen ²
Architectural Engineering Department
Faculty of Engineering
The British University in Egypt (BUE) El Shorouk City - Cairo Suez Desert
Road Postal No. 11837 - P.O. Box 43
Tel.: (+202) 26890000
E-mail ¹: ayman.othman@bue.edu.eg
E-mail ²: Noha115481@gmail.com
ORCID ID ¹: Orcid.org/0000-0001-9842-3885
ORCID ID ²: Orcid.org/0000-0002-2115-4418

ABSTRACT

Purpose of this paper
This paper aims to investigate the role of environmental ethics towards increasing the competitiveness of Architecture design firms (ADFs) through delivering sustainable designs. It aims to improve the ADFs reputation in the industry, provide a fair environment between the current and future generations and introduce a new aspect of competitiveness in the construction market.

Design/methodology/approach
To achieve this aim, a research methodology is designed to achieve three objectives through the following:

1. Reviewing literature related to addressing the gap in the current construction literature. It investigates the different aspects of ethics concept, analyses the code of conduct and competitiveness in ADFs.
2. Presenting and analysing a case study to investigate the implementation of environmental ethics in ADFs and its effect on the environment.
3. Investigating the perception and application of environmental ethical behaviour as well as the implementation of the architectural code of conduct, as it plays an essential role in the ethical application through conducting a survey questionnaire with a representative sample of (ADFs) in Egypt.

Research limitations

The limitations and constraints on the research include:

- The ADFs that received the survey questionnaire and responded were restricted in the province of Cairo, Egypt as an example for the developing countries.

Findings

The ADFs are well acquainted with the environmental ethics concept and how it may contribute to their success. However, there are obstacles hindering them from implementing it. To perceive green marketing, some ADFs seek an environmental ethical reputation globally; yet, when compared to the profit, it is preferable to be environmentally unethical. The absence of a sustainable environmental code of conduct in the ADFs is affecting not only the reputation of the profession but also badly influencing the environment. This initiates the implemention of environmental ethics in order to correspond to the globalization in a sustainable way.

Environmental designs would definitely add value to the construction market; even though the relation between the environmental ethics, sustainability and ADFs is still not widely recognized in the developing countries due to the poor concern of the ADFs towards preserving the surrounding environment. When Environmental ethical designs are implemented as a competitiveness strategy for the architectural projects, an international reputation could be gained; that will definitely enhance the firm’s competitive advantage and enhance the international investments.

Keywords: Environmental ethics, sustainable development, competitive advantage, ADFs

Originality / Value

This research aims to identify and discuss an area that was not covered well in the construction literature, specifically in the architectural fields. It is concerned with the important issue which is sustainable development. It aims to investigate the reasons that hinder the ADFs from implementing...
environmental ethics in addition to considering it a competitive advantage. A research paper was developed through this research and was presented in the Mega Sustainable Projects conference: Chance- Change -Challenge, Cairo, Egypt in May 2016.

1. Introduction
The paper presents a field study that examines the environmental ethics perception in the current construction market and how it could be considered as a privilege for the ADFs' competitiveness. This aim is attained through integrating three main objectives along with the methodology to achieve it. The concept of ethics, sustainable development and ADFs competitiveness are then presented along with an overview about the relationship between the environmental ethics, sustainable development, code of conduct and the ADFs competitiveness. A case study is then analysed to investigate the implementation of environmental ethics in ADFs and its effect on the environment. The survey questionnaire is then prepared and distributed amongst a representative sample of ADFs in Egypt as a developing country. The data collected is then analysed both quantitatively and qualitatively.

2. Research Objectives and Methodology
Building a comprehensive background using the literature review supported from previously written articles about the discussed topic. A case study is then analysed to achieve the second objective using the literature review as well. A survey questionnaire is prepared and distributed over a representative sample of architects in Egypt's ADFs.

3. Literature Review
3.1 Concept of ethics:
According to Vee & Skitmore (2003), ethics is defined as a system of moral principles through which human behaviour is judged whether it is good or bad. It is how a person can translate his values and beliefs to actions that involve a cost where people may differ more in their ethics rather than their beliefs. Organization's strategic objectives will be affected if it adopted a translation of its values into an ethic while changing in value alone will not cause the change in the organizational performance. According to a survey conducted in America, to investigate whether the construction industry suffers from illegal acts or not, 84% of the respondents said that they witnessed or observed unethical behaviour in the construction industry yet it is an issue that nobody wants to talk about. Moreover, 69% of the respondents believe that the construction industry needs to pay more attention to the unethical issues while 24% said they might work with unethical
contractors if they had to. On the other hand, 44% of the survey's respondents strongly disagreed that the construction industry includes illegal acts (Parson, 2005).

3.2 Sustainable development
Owing to the environmental dilemmas appearing in the last decade, the concept of sustainability and sustainable development were given a global attention. Since buildings, infrastructure and the environment are robustly attached, it was found that energy, water, materials and land are expended to maintain buildings, construction and infrastructure; consequently cursedly influencing the environment. According to Brundtland report (1987 cited in Darwish et al., 2010), Sustainability can be defined as the development that meets the current needs without compromising the ability of the future generations to meet their needs. In order to achieve sustainability and to develop better life quality, four objectives must be met (Giddings, Hopwood, & O'Brien, 1999):
1. Effective environmental protection
2. Wise utilization of the natural resources
3. Recognizing the needs of everyone thus achieving social progress
4. Maintaining high levels of economic growth and employment

In the 5th annual FMI/CMAA Survey of Owners conducted in (2004), emphasizing on the importance of conducting green buildings, 38% of the survey respondents found that implementing environmental sustainability importance is increasing gradually compared to 20% who found it as a non-important factor. Furthermore, Hopkirk,(2015) stated that the architecture profession is in a need to stand out and insist on conducting environmentally sustainable designs. In addition, it was emphasized on the ADFs need to work ethically.

3.3 Competitiveness in ADFs
According to the Institute of Destination Architects and Designers (2003), it argued that corporates cannot be competitive as long as they do not implement ethics. According to the Fortune Business leaders Council Survey (FBCS) (2006) corporates that adhere to implementing ethics most likely benefit from long-term competitiveness. ADFs seek being sustainable in the construction market. According to Azmi (2006), entailing environmental ethics and code of conduct is a major way to achieve this aim. Encompassing environmental ethics within the codes of conduct will enhance the competitive advantage of the ADFs (Petrick & Quinn, 2001). Where delivering sustainable designs not only benefit the environment but also it has economic benefit in which it saves time, money and reduce construction waste. The construction industry purpose is not only to make money but also to serve the general welfare which is incompatible with most of the researchers who argued that the main reason behind the unethical practice is that ADFs ignore ethics for the sake of being competitive and make profit for survival (Al-sweity & Enshassi, 2013).
3.4 The relationship between the environmental ethics, sustainable development, code of conduct and the ADFs competitiveness

The inadequate architectural designs development in the developing countries has shown an insight on the ADFs burdening the environmental design consideration of the firm's resources. In addition, most of the governmental codes ignore the architects' responsibility towards the surrounding environment. Despite the major contribution of those codes, they are not implemented. Some of these codes highlight the importance of providing sustainable development, yet it is considered general wording that hinder the architects from addressing different situations. Implementing environmental ethics was proved that it could play a key role in enhancing the ADFs competitive advantage in the developed countries. The study has showed that the ADFs in the developing countries fail to incorporate the sustainable environmental designs. This requires improving the clients and architects awareness and improving the sustainable design skills; thus, to initiate the environmental ethical sustainable designs for better market competitiveness.

4. Case Study

The Cairo Financial Centre (CFC) is an emerging business community that reflects the massive development in the business energy in Cairo. It is located along Salah -Salem road, below Salah El Din citadel; Al Qalaa region, Cairo, Egypt as shown in figure 1.

Figure 1: location of CFC in relation to the citadel (Shehata, 2014)

4.1 Project description

The project aims to provide a financial and touristic centre, which is composed of a business, and commercial complex that entails office accommodation, five stars hotel, retail outlets, conference centre, entertainment centre, exhibition and health club. The project is bounded by Mokattam hills from the south and three main ways from the North West
direction to provide accessibility. The main threat of the project that it will visually affect the citadel as it is located in the Qalaa’s region as well as its effect on the location; it might suppress the citadel site from the heritage list.

According to those restrictions, the UNESCO provided a strict report to overcome the visibility problems of the project. Several designs were proposed and redesigned again to match the UNESCO requirements and to blend with the Mokattam hills. Also, the project height was reduced from 59 m to 31.5 m so the project area increased as shown in figure 2.

4.2 Summary of findings
The project was stopped because of the threat it is causing on Salah El Din citadel, which is visible from all over Cairo. Moreover, the project was not completed as it will increase the traffic congestion and threaten Mokattam hills stability. This reflects the environmental ethical behaviour considered throughout the project, in which it was rejected because of the obstructed view it will cause for a monumental heritage as the citadel and the other environmental and social factors mentioned.

5. Data Analysis

5.1 Response Rate
The sample size consisted of 44 ADFs in Egypt. Forty-four survey questionnaires were distributed among several ADFs in Cairo regions. However, only thirty-five responses were received, representing a response rate of 77% which provides adequate information on the topic in question.

Table 5.1- Response Rate

<table>
<thead>
<tr>
<th>Survey Type</th>
<th>Planned</th>
<th>Response</th>
<th>% Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Questionnaires</td>
<td>44</td>
<td>34</td>
<td>77%</td>
</tr>
</tbody>
</table>

Figure 2: stepped design of the project (Shehata, 2014)
1.2 Analysis of Survey questionnaire

- 79.4% of the ADFs perceive the environmental ethics concept as represented in figure 3. 5 out of 34 respondents ranked their perception as poor, 13 out of 34 respondents choose moderate, 8 out of 34 respondents choose good, 6 out of 34 respondents choose very good and 2 out of 34 respondents choose excellent representing 5.9% indicated that their firm has very high perception of the mentioned concept as shown in figure 4.

![Figure 3: Environmental ethics concept awareness](image)

![Figure 4: Environmental ethics respondent's perception](image)
21 out of 34 firms indicated that they are willing to have an environmental ethical reputation while the rest perceived it as something not of interest.

The highest ranked result for implementing environmental ethics as built in strategy was found to be “Better image in the construction market”. On the second place was enhancing the built environment which was found to be not the main expected result. To gain competitive advantage was found to be the least ranked occurring result which reflects that the ADFs do not seek gaining competitiveness through green marketing and that they gain competitiveness through less costly solutions.

Table 5.2- Environmental ethics corporate strategy factors

<table>
<thead>
<tr>
<th>Environmental ethics corporate strategy factors</th>
<th>Abbreviations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Better image in the construction market</td>
<td>EECS1</td>
</tr>
<tr>
<td>Enhance the built environment</td>
<td>EECS2</td>
</tr>
<tr>
<td>Enhance the international investment</td>
<td>EECS3</td>
</tr>
<tr>
<td>More projects and tenders</td>
<td>EECS4</td>
</tr>
<tr>
<td>Gain competitive advantage</td>
<td>EECS5</td>
</tr>
</tbody>
</table>
out of 34 respondents rated their designers awareness level towards environmental ethics and sustainability principles as poor while 13 out of 34 respondents choose moderate, 12 out of 34 respondents rated their awareness degree as good, only 3 out of 34 respondents choose very good and no one had an excellent degree of awareness in the whole sample as shown in figure 6.

Figure 5: Relative importance index (RII) for EECS (environmental ethics corporate strategy) factors
3 out of 34 respondents strongly disagreed that implementing environmental ethics would boost their firms' competitiveness, 5 out of 34 respondents disagreed, 7 out of 34 respondents neither agreed nor disagreed, 14 out of 34 respondents agreed that implementing it would positively enhance their competitive advantage and 5 out of 34 respondents strongly agreed about that.

Figure 6: Awareness level percentage

Figure 7: Firms perception towards the environmental ethics competitiveness enhancement
5.2 Summary of Findings

- The ADFs are aware of the environmental ethics concept.
- ADFs seek to have an environmental ethical reputation globally to perceive green marketing, however, there are obstacles hindering them from implementing it.
- The ADFs believe that environmental designs would add value to their competitiveness in the construction market. Yet, when compared to the profit, it is preferable to be environmentally unethical.
- There is no code of conduct for the sustainable environmental designs in the ADFs.
- It is believed that providing environmentally ethical leadership may contribute to implementing these designs. Furthermore, raising the clients and architects awareness will help in spreading the delivering of sustainable designs.

6. Conclusions and recommendations

The entailed study presented an addition to the original body of knowledge by highlighting the major fragmentation toward the illegal tainted construction market that resulted from the various forms of unethical behaviour. The ethics concept was examined along with the Sustainable development implementation and competitiveness in ADFs were analysed. A field study was presented to examine the perception of environmental ethics in ADFs and to address the gap in the ADFs and their irresponsible perception pertaining integrating sustainable designs. To overcome this problem, based on the literature findings, the research may come with these fundamental recommendations:

6.1 Recommendations to Government

- The government should consider obligating sustainable development partnerships with other construction professionals as well to improve the entire construction performance towards the surrounding environment.
6.2 Recommendations to the developing countries ADFs

- ADFs should play a vital role in initiating sustainable development through delivering sustainable environmental designs through encouraging the architects and enhancing the client awareness.
- Encourage the implementation of sustainable environmental designs so that the profession can be a pioneer in solving others problems as well.

7. References


Effects of Design-Management Related Material Waste Causes on Project-Cost Overrun in Abuja, Nigeria

Ibrahim SAIDU¹, Winston MW SHAKANTU²
s214344924@nmmu.ac.za, Winston.shakantu@nmmu.ac.za
¹Department of Construction Management, the Nelson Mandela Metropolitan University, Eastern Cape, Port Elizabeth, South Africa (+27810916224)
²Department of Construction Management, the Nelson Mandela Metropolitan University, Eastern Cape, Port Elizabeth, South Africa; (+7785147492, +27415041400).

ABSTRACT

Background

Material wastage and cost overruns are common problems affecting construction projects in the Nigerian construction industry. These problems occur at different stages of a project, from planning, design, estimating, and construction to project completion.

Purpose of the paper

This paper examines the effects of material-waste causes and their control measures on cost overruns at the design-management stage of a project.

Research methodology and implications

The quantitative approach that is rooted in the positivist research paradigm was adopted. Interview was conducted with thirty (30) construction professionals from which a structured questionnaire (tick-box) was ticked-marked by the researcher. The information generated from the tick-box questionnaire was the only data utilised in this research. The professionals were purposeful selected based on project value of 8million USD and above. The collected data were analysed using the descriptive method (cross-tabulation). ANOVA was used to compare the views of different professionals on the effects of waste causes on cost overrun at the design-management stage of a project.
Findings based on the empirical research

The paper found that material-waste causes and their control measures have significant effects (very-high, high, medium, low, and very-low) in causing or minimising cost overruns at the design-management stage of a project. There was no significant difference in the views of the professionals on the effects of material waste on cost overrun at the design management stage of a project.

Practical implications and outcomes

Management of material waste and cost overrun should be revised based on the findings of this research as a reference document and included as part of the design-management process for a project.

Key words: Control measures, Cost overruns, Design management, and Material waste.

1. INTRODUCTION

Cost overrun and material waste are common problems in both developed and developing nations which makes it difficult for many projects to be completed within their budget (Saidu and Shakantu, 2015). Ameh and Itodo (2013) highlighted that in every 100 houses built there is sufficient waste material to build another 10 houses. Also, 10% of materials delivered to site in the UK end up as a waste that may not be accounted for (Osmani, 2011).

The argument in the construction industry on how to reduce or totally remove cost overruns from projects has been on-going among the built environment professionals, project owners and the users for the past seventy years (Apolot et al., 2010; Allahaim and Liu, 2012), but there is no substantial improvement nor significant solution in mitigating its detrimental effects (Allahaim and Liu, 2012).

Material waste and cost overrun are occasioned by several causes at different stages of projects, including planning, estimating, design and design management, and construction stage. Identification of these causes and the application of relevant control measures to minimise their occurrence is a step towards alleviating the consequences (Mou, 2008; Oladiran, 2009; Nagapan et al., 2012; Saidu and Shakantu, 2015). While Ameh and Itodo (2013) believed that building material wastage on construction sites accounts for cost overruns; they also highlighted that most managers of construction projects pay little attention to the effects of material waste generated on cost overrun in Nigeria.

Many studies have been carried out in this field, for instance, Ameh and Itodo (2013), Tam, Shen, and Tam (2007), and Saidu and Shakantu
(2015), but still, there is need for a research that provides an objective assessment of the effects of design management related material-waste causes and their control measures on project cost overrun. Hence, this research aims to examine the effects of design management related material-waste causes and their control measures on project cost overrun in Abuja, Nigeria.

2 LITERATURE REVIEW

2.1 Relationship between material waste and cost overrun

Construction waste was generally classified into physical waste and the non-physical waste (Nagapan et al., 2012; Saidu and Shakantu, 2015). While the physical construction waste originates from the construction activities, renovation, demolition, and so forth; the non-physical construction waste comprises of time overrun and cost overrun (Ma, 2011; Nagapan et al., 2012). Saidu and Shakantu (2015) established that since construction waste entails both the physical and the non-physical waste, there is a relationship between material waste originating from the physical waste and cost overrun emanating from the non-physical waste, since they originate from the same construction-waste family. Consequently, Memon et al. (2014) added that the non-physical waste includes undesired activities which can cause the physical waste such as rework, unnecessary material movements, and so forth. This shows that cost overruns, time overruns and construction-material waste are generally categorised as construction waste. This is further supported by Ma (2011), who defines waste as anything that does not add value. Time overruns, cost overruns, and material waste do not add value to any project.

Saidu and Shakantu (2015) identified some causes of material waste that are related to the causes of cost overrun as shown in Table 2.1

<table>
<thead>
<tr>
<th>S/n</th>
<th>Causes of Cost overrun</th>
<th>Cost overrun</th>
<th>Material waste</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Design error</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>2</td>
<td>Deficiencies in cost estimates</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>3</td>
<td>Insufficient time for estimate</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>4</td>
<td>Improper planning at on stage</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>5</td>
<td>Political complexities</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>6</td>
<td>Insurance problems</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>7</td>
<td>Changes in material specification</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>8</td>
<td>Laws and regulatory framework</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>9</td>
<td>Poor design management</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>10</td>
<td>Lack of design information</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>11</td>
<td>Designing irregular shapes and forms</td>
<td>✔</td>
<td>✔</td>
</tr>
</tbody>
</table>
3. RESEARCH METHODOLOGY

The research employed the use of quantitative method that is rooted in the positivist research paradigm. The study covered building construction projects within Abuja, the Federal Capital Territory of Nigeria. Abuja was selected because, it is one of metropolitan cities that has the highest population of professionals within the built environment and has many ongoing construction projects.

Interview was purposefully conducted with the construction professionals handling a project (private or public projects) with a value of 1.6 billion Naira / 8 million USD and above. The basis or rationale for this selection is that projects of this value and above are likely to produce large quantities of material waste and huge amount cost overruns when compared with the projects of less value. The respondents comprised: 15 Project Managers (PMs), 9 Quantity Surveyors (QSs), 5 Site Engineers (SEs) and 1 Senior Technical Officer (STO) of a waste management department.

A tick-box structured questionnaires on the issues relating to the material waste causes and cost overruns at the design-management stage of a project were ticked/marked by the interviewer in the course of the interview and these addressed the quantitative nature of this research. The research employed the descriptive and inferential analyses. The descriptive tool that was used to analyse the data (questionnaires / tick-box) was the cross tabulation method. The results were presented in Tables 4.1 and 4.2. The responses from the tick-box questionnaires are rated based on the cut-off points highlighted by Morenikeji (2006) in a five Likert scale that, the material-waste causes and control measures that have percentage of “90 to 100” are rated “very high effect”; 70 to 89% are rated “high effect”; 50 to 69% are rated “moderate effect”; 30 to 49% are rated “little effect”; and 29 to 1% are rated “very little effect” on cost overruns. The analysis of variance (one-way ANOVA) was used to compare, if there is DIFFERENCE in the views of the respondents on the results of the effects of material-waste causes on cost overrun.

<table>
<thead>
<tr>
<th></th>
<th>Material Waste Causes</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td>Lack of communication among parties</td>
<td>✓ ✔</td>
</tr>
<tr>
<td>13</td>
<td>Change in the scope work</td>
<td>✓ ✔</td>
</tr>
<tr>
<td>14</td>
<td>Delay payment to supplier/subcontractors</td>
<td>✓ ✔</td>
</tr>
<tr>
<td>15</td>
<td>Shortage of materials</td>
<td>✓ ✔</td>
</tr>
<tr>
<td>16</td>
<td>On-site waste</td>
<td>✓ ✔</td>
</tr>
<tr>
<td>17</td>
<td>Project size</td>
<td>✓ ✔</td>
</tr>
<tr>
<td>18</td>
<td>Lack of constructability</td>
<td>✓ ✔</td>
</tr>
<tr>
<td>19</td>
<td>Unrealistic contract duration</td>
<td>✓ ✔</td>
</tr>
<tr>
<td>20</td>
<td>Rework</td>
<td>✓ ✔</td>
</tr>
</tbody>
</table>
4. RESULTS AND DISCUSSION

This section presents and discusses the results of this study.

4.1 Effects of material-waste causes on cost overruns at design management stage of a project

The results in table 4.1 indicate that the percentages of 100, 93.3, 93.3, 90, 90, and 90 relative to “error in design and detailing, ranked 1st”; “frequent design changes and material specification, ranked 2nd”; “lack of design information, ranked 2nd”; “design complexity / complication, ranked 4th”; “poor management of design process, ranked 4th”; and “inexperienced designer or design team, ranked 4th”; respectively, by the respondents were the causes of material waste deemed to have ‘very high effects’ on project cost overruns at the design management stage of a project; because they fall between 90 and 100 percent. While the percentages of 86.7, 86.7, and 80 relatives to “difficulty in interpreting material specifications, ranked 7th”; “readability, constructability and maintainability problems of design, ranked 7th”; and “the lack of standardisation in design/sizes and units, ranked 9th”; respectively, were deemed to have ‘high effects’ on cost overruns; because they fall between 70 and 89 percent.

These results imply that design and detailing errors are mostly caused by inexperienced designers and poor management of design process. These could lead to a wrong estimation; because, the estimates are generated and solely depend on the design, and thereby having a serious impact on the project cost. These are in line with the findings of Ameh and Osegbe (2011); Love et al. (2011); Memon et al. (2011); Baloyi and Bekker (2011); Allahaim and Liu (2012); and Shamugapriya and Subramanian (2013) on the practical causes of cost overruns and material waste.

Percentages of 66.7, 63.3, 56.7, and 56.7 in respect of “poor harmonization of clients’ brief, ranked 10th”; “designing uneconomical shapes and outlines, ranked 11th”; “poor communication flow among design team, ranked 12th”; and “the lack of buildability analysis, ranked 12th”; respectively, were the material waste causes deemed to have ‘moderate effects’ on project-cost overruns; because they fall between 50 and 69 percent.

Other material waste causes of percentages between 1 and 29 percent were deemed to have ‘very little effects’ on cost overruns at the design stage of a project. They included; “poor knowledge of the changing design requirements, ranked 19th”; “designing dead spaces, ranked 20th”; and “aesthetic considerations, ranked 22nd”. This is probably because; the respondents believed that dead spaces and aesthetic issues must have been included in the design, which the estimator must have considered in
the estimating process. Therefore, have little effect in causing cost overruns.

### Table 4.1 Results of cross-tabulation for the effects of material-waste causes of on cost overruns at design management

<table>
<thead>
<tr>
<th>S/n</th>
<th>Causes of material waste that have effect on cost overrun at design management stage</th>
<th>PMs</th>
<th>QSs</th>
<th>STO</th>
<th>Total</th>
<th>Ranking</th>
<th>Decision</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Frequent design changes &amp; material specification</td>
<td>15</td>
<td>9</td>
<td>4</td>
<td>28</td>
<td>2</td>
<td>(93.3%) Very High</td>
</tr>
<tr>
<td>2</td>
<td>Error in design and detailing</td>
<td>15</td>
<td>9</td>
<td>5</td>
<td>1</td>
<td>30</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>Lack of design information</td>
<td>13</td>
<td>9</td>
<td>5</td>
<td>1</td>
<td>28</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>Design complexity / complication</td>
<td>13</td>
<td>9</td>
<td>5</td>
<td>0</td>
<td>27</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td>Poor communication flow among design team</td>
<td>8</td>
<td>6</td>
<td>3</td>
<td>0</td>
<td>17</td>
<td>12</td>
</tr>
<tr>
<td>6</td>
<td>Designing dead spaces</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>20</td>
</tr>
<tr>
<td>7</td>
<td>Poor knowledge of the changing design requirements</td>
<td>0</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>4</td>
<td>19</td>
</tr>
<tr>
<td>8</td>
<td>Poor management of design process</td>
<td>13</td>
<td>9</td>
<td>5</td>
<td>0</td>
<td>27</td>
<td>4</td>
</tr>
<tr>
<td>9</td>
<td>Inexperience designer / design team</td>
<td>14</td>
<td>8</td>
<td>4</td>
<td>1</td>
<td>27</td>
<td>4</td>
</tr>
<tr>
<td>10</td>
<td>Interaction between various specialists</td>
<td>6</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>10</td>
<td>14</td>
</tr>
<tr>
<td>11</td>
<td>Designing uneconomical shapes and outlines</td>
<td>12</td>
<td>6</td>
<td>0</td>
<td>1</td>
<td>19</td>
<td>11</td>
</tr>
<tr>
<td>12</td>
<td>Lack of standardization in design/ sizes and units</td>
<td>12</td>
<td>8</td>
<td>5</td>
<td>1</td>
<td>26</td>
<td>7</td>
</tr>
<tr>
<td>13</td>
<td>Lack of buildability analysis</td>
<td>7</td>
<td>6</td>
<td>3</td>
<td>1</td>
<td>17</td>
<td>12</td>
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<td>14</td>
<td>Difficulty in interpreting material specifications</td>
<td>14</td>
<td>6</td>
<td>5</td>
<td>1</td>
<td>26</td>
<td>7</td>
</tr>
<tr>
<td>15</td>
<td>Readability, constructability &amp; maintainability</td>
<td>13</td>
<td>6</td>
<td>4</td>
<td>1</td>
<td>24</td>
<td>9</td>
</tr>
<tr>
<td>16</td>
<td>Insufficient time for design</td>
<td>3</td>
<td>2</td>
<td>4</td>
<td>0</td>
<td>9</td>
<td>16</td>
</tr>
<tr>
<td>17</td>
<td>Poor harmonization of client's brief</td>
<td>9</td>
<td>7</td>
<td>3</td>
<td>1</td>
<td>20</td>
<td>10</td>
</tr>
<tr>
<td>18</td>
<td>Over or under designing</td>
<td>4</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>8</td>
<td>17</td>
</tr>
<tr>
<td>19</td>
<td>Poor structural</td>
<td>2</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>5</td>
<td>18</td>
</tr>
</tbody>
</table>
4.2 Effects of material-waste control measures on cost overruns at design management stage of a project

It is apparent from Table 4.2 that the percentages of 100, 100, 93.3, 93.3, and 93.3 relative to “explicit detailing in design, ranked 1st”; “interpretable designs and specifications, ranked 1st”; “engaging an experienced designer, ranked 3rd”; “error-free design, ranked 3rd”; and “proper design information and consultation, ranked 3rd”; respectively, by the respondents were considered to be the material waste-control measures that have ‘very high effects’ in controlling project-cost overruns at the design management of the pre-contract stage of a project; because they fall between 90 and 100 percent. Furthermore, percentages of 86.7, 86.7, and 76.8 relative to “proper management of design process, ranked 6th”; reduced design complexity, ranked 6th”; and “readability, constructability and maintainability in design, ranked 8th”; respectively, by the respondents were considered to be the material waste-control measures that have high effect on cost overruns; because they fall between 70 and 80 percent.

These results are also in line with the findings of Abdul-Azis et al. (2013) on the control measures for project-cost overruns. Also, the results confirm the findings of Osmani et al. (2008) on the management measures for material waste at the design stage of a project.

Also, “standardization in design, ranked 9th”; and “designing economic shapes and outlines, ranked 10th”; respectively, were rated as having ‘moderate effect’ in controlling cost overruns by the respondents; because they fall between 50 and 69 percent.

“The use of prefabricated units and standardised material sizes, ranked 14th”; “design for materials optimisation, ranked 17th”; “design for offsite construction, ranked 17th”; “the early engagement of a designer, ranked 21st”; and “improving on previous design mistakes, ranked 21st”; respectively, were considered by the respondents to have ‘little effect’ in controlling the project-cost overruns at the design management stage for a project. These results support the findings of Abdul-Azis et al. (2013) on the control measure for project-cost overruns.
<table>
<thead>
<tr>
<th>S/n</th>
<th>Control measures for material waste that have effects on cost overrun at design stage</th>
<th>PMs</th>
<th>QSs</th>
<th>SEs</th>
<th>STO</th>
<th>Total</th>
<th>Ranking</th>
<th>Decision</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Design for materials optimization</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>17</td>
<td>(10%)</td>
</tr>
<tr>
<td>2</td>
<td>Design for reuse and recovery</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>16</td>
<td>(13.3%)</td>
</tr>
<tr>
<td>3</td>
<td>Design for offsite construction</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>17</td>
<td>(10%)</td>
</tr>
<tr>
<td>4</td>
<td>Designing for deconstruction</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>19</td>
<td>(6.7%)</td>
</tr>
<tr>
<td>5</td>
<td>Use of prefabricated units and standard materials</td>
<td>2</td>
<td>4</td>
<td>0</td>
<td>1</td>
<td>7</td>
<td>14</td>
<td>(23.3%)</td>
</tr>
<tr>
<td>6</td>
<td>Communication &amp; coordination of design process</td>
<td>4</td>
<td>4</td>
<td>1</td>
<td>0</td>
<td>9</td>
<td>12</td>
<td>(30%)</td>
</tr>
<tr>
<td>7</td>
<td>‘Designing economic shapes and outlines</td>
<td>6</td>
<td>0</td>
<td>1</td>
<td>9</td>
<td>19</td>
<td>10</td>
<td>(63.3%)</td>
</tr>
<tr>
<td>8</td>
<td>Incorporation of large-panel metal formworks</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>0</td>
<td>23</td>
<td>(0%)</td>
</tr>
<tr>
<td>9</td>
<td>Reduction in the rate of design change</td>
<td>9</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>12</td>
<td>11</td>
<td>(40%)</td>
</tr>
<tr>
<td>10</td>
<td>Utilization of modular designs</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>19</td>
<td>(6.7%)</td>
</tr>
<tr>
<td>11</td>
<td>Reduced design complexity</td>
<td>12</td>
<td>9</td>
<td>5</td>
<td>0</td>
<td>26</td>
<td>6</td>
<td>(86.7%)</td>
</tr>
<tr>
<td>12</td>
<td>Explicit detailing</td>
<td>15</td>
<td>9</td>
<td>5</td>
<td>1</td>
<td>30</td>
<td>1</td>
<td>(100%)</td>
</tr>
<tr>
<td>13</td>
<td>Interpretable design and specifications</td>
<td>15</td>
<td>8</td>
<td>4</td>
<td>1</td>
<td>28</td>
<td>3</td>
<td>(93.3%)</td>
</tr>
<tr>
<td>14</td>
<td>Experienced Designer</td>
<td>15</td>
<td>9</td>
<td>5</td>
<td>1</td>
<td>30</td>
<td>1</td>
<td>(100%)</td>
</tr>
<tr>
<td>15</td>
<td>Proper management of design process</td>
<td>13</td>
<td>8</td>
<td>5</td>
<td>0</td>
<td>26</td>
<td>6</td>
<td>(86.7%)</td>
</tr>
<tr>
<td>16</td>
<td>Error-free Design</td>
<td>13</td>
<td>9</td>
<td>5</td>
<td>1</td>
<td>28</td>
<td>3</td>
<td>(93.3%)</td>
</tr>
<tr>
<td>17</td>
<td>Standardization in Design</td>
<td>10</td>
<td>5</td>
<td>4</td>
<td>1</td>
<td>20</td>
<td>9</td>
<td>(93.3%)</td>
</tr>
<tr>
<td>18</td>
<td>Readability, constructability and maintainability</td>
<td>11</td>
<td>7</td>
<td>4</td>
<td>1</td>
<td>23</td>
<td>8</td>
<td>(76.7%)</td>
</tr>
<tr>
<td>19</td>
<td>Proper design Information and consultation</td>
<td>13</td>
<td>9</td>
<td>5</td>
<td>1</td>
<td>28</td>
<td>3</td>
<td>(93.3%)</td>
</tr>
<tr>
<td>20</td>
<td>Adherence to clients brief</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>5</td>
<td>15</td>
<td>(16.7%)</td>
</tr>
<tr>
<td>21</td>
<td>Sufficient time for design</td>
<td>3</td>
<td>2</td>
<td>4</td>
<td>0</td>
<td>9</td>
<td>12</td>
<td>(30%)</td>
</tr>
<tr>
<td>22</td>
<td>Early engagement of designer</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>21</td>
<td>(3.33%)</td>
</tr>
</tbody>
</table>
4.3 Comparative views of respondents on the effects of material-waste causes and control measures on project cost overruns at design management stage of a project

Table 4.3 shows the results of ANOVA analyses performed to compare the views of professionals (Project managers, Quantity Surveyors, Site Engineers and Senior Technical Officer) on the 'effects of material waste, causes, and control measures on project-cost overruns' at the design management stage of a project.

It was apparent from the analyses that the values of $f$-calculated (0.150 and 0.319) for the two analyses (material waste sources and causes, and control measures), respectively, were both less than the value of $f$-tabulated (1.701); and the probability values (0.861 and 0.730) were greater than 0.05 (5%) level of significance within the mean-squared group of 0.90 to 6.02 and 1.39 to 4.35, respectively.

The evidence is not statistically significant. These results imply that the respondents were of the same views on the effects of material-waste causes and the control measures on cost overruns at the design management stage of a project.

Table 4.3 Results of ANOVA analyses for the test of differences in professional views on the effects of material-waste causes and control measures on cost overruns

<table>
<thead>
<tr>
<th>Sn</th>
<th>Variables</th>
<th>Observation</th>
<th>Inferences</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Type of Analysis</td>
<td>Mean square within group</td>
<td>F-cal</td>
</tr>
<tr>
<td>1</td>
<td>Sources &amp; causes</td>
<td>One-way ANOVA</td>
<td>0.90</td>
</tr>
<tr>
<td></td>
<td>Sources &amp; causes</td>
<td>One-way ANOVA</td>
<td>1.39</td>
</tr>
</tbody>
</table>

Control measures
5. CONCLUSION AND RECOMMENDATIONS

Material waste and cost overrun are identified as global problems which affect the success of many construction projects. Moreover, most managers of construction projects pay little attention to the effects of material waste generated on cost overrun. The aim of this research was to examine the effects of material-waste causes and their control measures on cost overruns at the design management stage of a project. It was found that material-waste causes and their control measures were identified to have significant (very-high, high, medium, low, and very-low) effects in causing/controlling cost overruns at the design management stage of a project. Also, there was no statistically significant difference in the views of the respondents on these issues. The respondents have the same views on the results of the effects of material-waste causes and control measures on cost overruns at the design-management stage of a project. Based on these findings, it can be concluded that effective management of design related material waste would translate into a reduction in the level of cost overrun for a project.

It is important that careful consideration be given to the issues identified in this study, most especially the material-waste causes and the control that have very-high and high effects on cost overruns at the design management stage; as these would assist in achieving a reduction in the rate of material waste and cost overrun for a project. Management of material waste and cost overruns for a project should be revised, based on the findings of this research and included as part of the initial project procurement process.

Further research should be conducted to investigate the effects of material waste causes on cost overrun at the post-contract stages of a project.

6. REFERENCES


INTEGRATION OF GREEN BUILDING (GB) CONCEPT IN DESIGN: AN EXPLORATIVE STUDY

Aiyetan, Ayodeji Olatunjí¹, Brink Botha², Chris Adendorff³ & Lungile Mxube⁴
ayodejia@dut.ac.za and brink.botha@nmmu.ac.za
¹Department of Construction Management and Quantity Surveying, Fac. of Engr., Built Env. And Sciences, Durban Univ. of Techn., Durban, KwaZulu-Natal, South Africa.
Tel. no.: +27(0) 31 373 2585
²Department of Construction Management, Faculty of Engineering, the Built Environment, and IT, Nelson Mandela Metropolitan University, Port Elizabeth, South Africa.
Address of author(s)’ employing institution(s) (including office Tel. no.):
+27(0) 41 504 2790

ABSTRACT AND KEYWORDS

Purpose of this paper
Green Building is a concept that when embraced could result in enormous benefits relative to the built space, resources, and human beings. The study aims to assess the integration of Green Building concepts at the early stage of design.

Design/methodology/approach
The study was conducted in Durban, South Africa. Respondents for the study were mainly Architects. Random sampling technique was employed in the selection of samples. A total of fifteen (15) questionnaires were analysed for the study, Descriptive statistics was employed for the analysis.

Findings
Findings include that the concept of Green Building principles integration demand is low in the construction Industry, therefore its low integration at the early stages of design, It was found that facilities procured via the concept of Green Buildings reduces their operating cost.

Practical implications
The application of the recommendations will lead to remarkable improvement in the integration of Green Building concepts at early stages of design and ensure sustainable growth of green space.

**Keywords:** Construction, design, green building, integration

1. **INTRODUCTION**

The US Green Building Council (USGBC) defines a Green Building as one that is built using processes that are environmentally responsible and resource efficient from conception to completion. Green Building design aims at resource-efficient building in design and construction, and at the operation phase. This aim implies:
- The minimisation of waste, and
- Low operational cost (reduced project life-cycle costs).

It is worth noting that the economic life cycle performance of integrated, sustainable design is a critical element to green building. Green Building practices benefit both building professionals and homeowners, communities, and the environment and afford sustainable future.

Buildings are responsible for between 40% and 60% of greenhouse gas emissions in the city, a major contributor to global climate change (Smart Living Handbook, 2011). This has resulted in a drive to reduce greenhouse gas emission and other environmental impacts for a more sustainable built environment and it starts from having a responsible environmental attitude and practice of green infrastructure design. Based on the above a study was initiated to assess the extent of integration of green building concepts in design. The reason for this is to reduce the impact that buildings have on the environment as well as the operating costs of running them.

2. **LITERATURE REVIEW**

2.1 Principles of Green Buildings

The various principles of Green building design as identified from literature are discussed below.

2.1.1 Be locally appropriate

Green building should be designed relative to suitability to social, economic, and cultural context of the community it is situated. Secondly, the community need to be involved from start to ensure adequate maintenance in the future (Smart Living Handbook, 2011) and (Fiocchi et al., 2011).

2.1.2 Conserve the natural environment
According to Kientzel and Kok (2011), green building should not adversely impact on the natural environment, relative to design and construction. An approach adopted which is aim at conserving the natural resources and ecosystems that sustains life in the area.

2.1.3 Use resources efficiently and effectively

One of the primary aim of green building design is regarding the maximizing efficiency of energy, water, and materials use of the building. Emerging technology, management systems, and behavioral change should be explored to effect efficient resource use throughout planning, design, construction and operation (Fiocchi et al., 2011 and Kientzel and Kok, 2011).

2.1.4 Apply a full life-cycle approach

Life cycle approach should be adopted in design, relative to materials to be incorporated in the building. This will afford the best option in the selection of materials. Attention should be given to resource intensity and end-of-life effect. Life – cycle costing should also be used to select design solutions that optimize the cost over the life of the building not just upfront (Smart Living Handbook, 2011).

2.1.5 Minimise waste

Green buildings should aim at minimizing waste at construction and operation. Ninety-five percent (95%) of material for green building for green building should be reusable and recyclable while eliminating those that are not through procurement and design of efficient system (Smart Living Handbook, 2011).

2.1.6 Use renewable resources

Green building should incorporate resources and materials that can be sustainably renewed through natural processes and sustainable culture such as, solar or wind energy, harvested rainwater and sustainable timber (Kientzel and Kok, 2011).

2.1.7 Implement sustainable procurement

The primary aim of green building is the preservation of the environmental resources. Therefore, in the procurement of goods and services for green building, adequate consideration must be given to this in the stages of planning, operation, management and maintenance (Fiocchi et al. 2011).

2.1.8 Utilise locally sourced materials and skills
This afford the creation of jobs for the locals and boost its economy, makes them get involved and uphold the concept of green building (Ibid).

2.1.9 Maximise the health and well-being of users

The materials incorporated in building should be such that is free of toxic emission to ensure the healthy living of people indoor and within the environment. Therefore, it should aim to ensure the well-being of people to live, work and play. Consideration should be given to natural light, indoor air quality, visual comfort and thermal comfort in the built environment (Ibid).

2.1.10 Allow real-time monitoring and evaluation

This is a new concept as such it requires the involvement of building managers and homeowners relative to keep records of performance of green building that can be use in future for improvement of green building facilities (Smart Living Handbook, 2011).

2.1.11 Leave a positive legacy

The life span of buildings are very long. The decisions on the various materials input will affect the fabric of the city for decades to come – decades which the threats of climate change, food security, and fresh water availability will become increasingly real. Therefore, it is important that buildings leave a positive legacy enabling the cities to meet these challenges in the future, thus ensuring sustainability (Smart Living Handbook, 2011).

2.2 Factors hindering the practice of green building

There are factors that hinder the practice of green building concepts in design, namely:

2.2.1 Developers and builders tend to keep things as simple as possible

Cost is a major consideration when deciding to factor sustainability into a new product or process. Building green buildings involve huge capital and for this reason most developers and builders tend to keep their building simple if money available cannot afford green building from inception (Frisk and Larson, 2011).

2.2.2 Lack of awareness

There seems to be a lack of awareness of green design principles and the success stories emanating of sustainable buildings, which are needed to foster further uses. These have constituted a hindrance to to the practice of green building designs (Rosen, 2013).
2.2.3 Market expectation

A lack of market forces that drive the practice of green design relative to inadequate customer demand for green building, stands as a hindrance to its practice (Ibid).

2.2.4 Lack of professionals to handle the task

Sustainable technology in new in most country, and in particular the African countries. Therefore there is a lack of professionals to handle the task and combined with the fact that customer demand and awareness are low. No effort is made to bring to the knowledge of the majority of green buildings and benefits, these all affects it practice (Ibid).

2.2.5 Economic situation

The economic situation of a country could contribute to non-practice of green building design and construction. The construction of wind farms and solar system that will be enough to supply the needed power to drive the economy of a nation will be large and replete. Secondly, on the part of individuals or organisations that will construct green facilities require huge sum of money, which may not be in the interest of these to embark on. These hinders the practice of green building (Lau, 2010).

2.2.6 Lack of technical know-how

Very few professionals have the technical know-how on green technology and the need for confidentiality to protect competitive advantages contributes to sharing of knowledge and lessons learned from applying sustainable designs (Means, 2004).

2.2.7 No enabling environment

The lack of codes and standards, regulations and laws calling for green buildings and in where these are available, there are no enforcement to drive these to reality (Ibid).

2.3 Benefits of Green Buildings

There are enormous benefits that could be derived from the use of green buildings, eleven benefits have been identified, namely

2.3.1 Energy cost saving

Energy usage in building is substantial and attracts high cost. This is reduced via energy efficiency and related measures incorporated in design. According to Gregory (2002), green building use 30% less energy when compared to conventional buildings. Gregory study of sixty (60) LEED
Leadership in Energy and Environmental Designs) rate buildings against the conventional buildings reveals that:
- On average 25-39% more energy efficient;
- Characterised by even lower electricity peak consumption;
- More likely to purchase grid power from renewable energy sources (green power and/or tradable renewable certificates).

2.3.2 Health and productivity

Smart Living Handbook (2011) point that people spend more than half their time indoors. The environment they live in must be free of harmful substances or emission. Material of green building are generally nontoxic which enhances good health. Health workers or people indicate constant productivity.

2.3.3 Environmental benefit for every one

Green building are made of renewable materials. As such they aim to conserve the natural resources and ecosystems that sustain life in the area of construction (Ibid).

2.3.4 Attracting and retaining employees

The use of local materials boost the local economy and promotes job security for people living in the area and retaining them, because they are familiar with these materials, they are comfortable working with them, therefore they are retained (Karolides, 2002).

2.3.5 Satisfaction from doing the right thing

Stemming from above, as a result of familiarity to material types and their technical know how relative to working on the materials, they derive satisfaction (Karolides, 2002) and (Smart Living Handbook, 2011).

2.3.6 Reduces liability risk

This is relative to bills that would accrue as a result of operating and maintenance cost of conventional buildings which are eliminated in green buildings. These include high monthly electricity and water bill among others (Karolides, 2002). Keep life intact – green buildings afford health living that may lead to long life (Smart Living Handbook, 2011).

2.3.7 Reduces the need for driving car

Smart-growth cuts oil use, greenhouse gas emissions, and other pollutants from transportation by as much as 50% compared to conventional sprawl (Ibid).
3. RESEARCH METHODOLOGY

A questionnaire survey was conducted relative to the study. A total of 25 questionnaires were returned completed and included in the analysis of the data. The sample frame consists of Architects. The administration of the questionnaire was through the e-mail and retrieved through the same. The study was conducted in Durban. Descriptive statistics were used for data analysis with the aid of the SPSS software package.

3.1 Profile of respondents

A brief description of the characteristics of the respondents surveyed is given as: in terms of qualification, B.Tech and M.Tech (65%) predominate, a low percentage (25.5%) have obtained their professional qualifications, The average years of experience of respondents is six (6) and the average number of projects handled by the respondents is six (6), and respondents within the years of 41-50 predominate (48.44%). It can be inferred that the data obtained from the respondents can deemed reliable, based on the above information.

3.2 Research Findings

Table 1 presents respondents rating of influencing factors of principles of green. The factor rated with the most influence relative to consideration in green design is locally appropriate (MS=4.85). This rating is traceable to the type of materials being used with respect to their acceptability and knowledge of their function and maintenance of the facility in future. Following closely is conserve the natural environment (MS=4.80). Green designs are such that preserves the natural resources, thereby allowing for future usage and the elimination of carbon dioxide, with a resultant reduction effect on be global warming. Next to conserving natural environment is a use resource efficiently and effectively (MS=4.55). Green building afford efficient and effect use of resources. The invention of electricity saving lamps, solar water heaters and so on has brought about this development, which allows resource usage for the future generations. Least among the factors that influences designing green is allow real-time monitoring and evaluation (MS=1.87). The minimal use of resources through green design has been proven severally, therefore the negligible influence of this factor. Next is leave a positive legacy (MS=2.31). This has moderate effect, since the mean score is close to half the value of the scale of measurement. Leaving a positive legacy is relative to the effect of climate and other physical environmental factors that may affect the fabric of the building, it is important that the material input withstand these. Next to leave a positive legacy is implement sustainable procurement (MS=2.35). This factor also has moderate influence with respect to designing green buildings. At each stage of procurement for the facility, consideration must be given to renewable materials and maintenance.
Table 1: Influence of principles of green building on design

<table>
<thead>
<tr>
<th>Principles</th>
<th>Mean score</th>
<th>Ranking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Be locally appropriate</td>
<td>4.85</td>
<td>1</td>
</tr>
<tr>
<td>Conserve the natural environment</td>
<td>4.80</td>
<td>2</td>
</tr>
<tr>
<td>Use resources efficiently &amp; effectively</td>
<td>4.55</td>
<td>3</td>
</tr>
<tr>
<td>Minimize waste</td>
<td>4.51</td>
<td>4</td>
</tr>
<tr>
<td>Use renewable resources</td>
<td>4.38</td>
<td>5</td>
</tr>
<tr>
<td>Utilize locally sourced materials</td>
<td>4.16</td>
<td>6</td>
</tr>
<tr>
<td>Apply a full life – cycle approach</td>
<td>3.80</td>
<td>7</td>
</tr>
<tr>
<td>Implements sustainable procurement</td>
<td>2.35</td>
<td>8</td>
</tr>
<tr>
<td>Leave a positive legacy</td>
<td>2.31</td>
<td>9</td>
</tr>
<tr>
<td>Allow real – time monitoring &amp; evaluation</td>
<td>1.87</td>
<td>10</td>
</tr>
</tbody>
</table>

Table 2 reveals respondents rating of factors hindering the practice of green building.

Table 2: Factors hindering the practice of Green Building design

<table>
<thead>
<tr>
<th>Factors</th>
<th>Mean score</th>
<th>Ranking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Developers &amp; builders tend to keep things as simple as possible</td>
<td>4.88</td>
<td>1</td>
</tr>
<tr>
<td>Lack of awareness</td>
<td>4.81</td>
<td>2</td>
</tr>
<tr>
<td>Market expectation</td>
<td>4.28</td>
<td>3</td>
</tr>
<tr>
<td>Lack of professionals to handle the task</td>
<td>3.91</td>
<td>4</td>
</tr>
<tr>
<td>Economic situation</td>
<td>3.42</td>
<td>5</td>
</tr>
<tr>
<td>Lack of technical know how</td>
<td>2.39</td>
<td>6</td>
</tr>
<tr>
<td>No enabling environment</td>
<td>2.23</td>
<td>7</td>
</tr>
</tbody>
</table>

The most rated factor is developers and builders tend to keep things as simple as possible (MS=4.88). This is traceable to the initial high cost required for the installation of renewable technology and products in homes. In addition, lack of awareness of these renewable and low energy consuming materials could be the likely reason militating against its practice. Next to developers and builders tend to keep things as simple as possible is lack of awareness (MS=4.81). The lack of knowledge of the existence, operation, and benefits that could accrue from the use of renewable energy or technology could hinder its practice. Next to lack of awareness is market expectation (MS=4.28). This suggests low market demand for green building, possibly a result of high initial capital outlay required, lack of awareness of technology, products, and benefits. The least factor contributing a hindrance to the practice of green building is no enabling environment (MS=2.23). The lack of government embarking on renewable technology such as wind, solar and hydro for the production of energy, laws and enforcing agents has led to an environment void of the practice of green building and designs.
Table 3: Benefits of Green Buildings

<table>
<thead>
<tr>
<th>Benefits</th>
<th>Mean score</th>
<th>Ranking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy cost saving</td>
<td>4.86</td>
<td>1</td>
</tr>
<tr>
<td>Health &amp; productively benefits</td>
<td>4.83</td>
<td>2</td>
</tr>
<tr>
<td>Preserving natural resources</td>
<td>4.81</td>
<td>3</td>
</tr>
<tr>
<td>Environmental benefit for every one</td>
<td>4.80</td>
<td>4</td>
</tr>
<tr>
<td>Attracting in retaining employees</td>
<td>3.98</td>
<td>5</td>
</tr>
<tr>
<td>Reduces water consumption</td>
<td>3.87</td>
<td>6</td>
</tr>
<tr>
<td>Satisfaction from doing the right thing</td>
<td>3.75</td>
<td>7</td>
</tr>
<tr>
<td>Reduces the need for driving car and so on</td>
<td>3.69</td>
<td>8</td>
</tr>
<tr>
<td>Reduces liability risk</td>
<td>3.62</td>
<td>9</td>
</tr>
<tr>
<td>Financial &amp; economic benefits</td>
<td>2.45</td>
<td>10</td>
</tr>
<tr>
<td>Keep life intact</td>
<td>2.33</td>
<td>11</td>
</tr>
</tbody>
</table>

Table 3 indicates respondents rating of the benefits of green building. Respondents rated energy cost saving (MS=4.86) as the highest benefit derived from green buildings. This is as a result of the diverse invention made regarding renewable technology and low energy consumption appliances and materials, which are incorporated in homes and reduces energy consumption. Next to energy cost saving is health and productivity benefits (MS=4.83). Green buildings do not produce toxic gases such as the conventional types that could affect well-being and productivity. Next to health and productivity benefit is preserving natural resources (MS=4.81). Green buildings stemming from green designs afford the preservation of natural resources for the use of the future generation. This is one great advantage relative to preserving the limited and scarce resources.

The factor with the least benefits according to the rating of respondents are keep live intact (MS=2.33), the least of them. Financial and economic benefits (MS=2.45) and reduces liability risk (MS=3.62). Keeps life intact implies not being harmful to human health, financial and economic benefits indicates savings from thee of green buildings, and reduces liability risk reveals the reduction in cost of maintenance through its life span of the building/facility.

4. CONCLUSIONS AND RECOMMENDATIONS

4.1 Conclusions

Be locally appropriate, conserve the natural environment, and use resources efficiently and effectively are the main principles of Green Building influencing its integration in design.
Developers and builders tend to keep things as simple as possible, lack of awareness, and market expectation are the most factors hindering the practice of Green Building designs. Based on these factors, it can be deemed that the integration of GB principles in design is low. Energy cost savings, health and productivity benefits, and preserving natural resources are the main benefits that could be derived from Green Building.

4.2 Recommendations

Engagement of client, community, and other professionals from the beginning to completion of Green Buildings, is emphasised to ensure that the project responds appropriately to local context. Developers and builders should embrace the concept of Green Building to mitigate wastage of natural resources and global warming. The construction of Green Building should be embedded in built environment our courses at the tertiary level and taught.

5. ACKNOWLEDGEMENTS

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6. REFERENCES

The US Green Building Council (USGBC) www.usgbc.org/