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ANALYSIS OF THE BENEFITS OF GREEN BUILDING IN SOUTH AFRICA

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ABSTRACT

This paper investigates the perceptions of built environment professionals with respect to the benefits of green buildings and identifies the benefits regarded as the most important to promote the adoption of green building. The primary data was collected from 106 green building-accredited professionals in both the public and private sectors who are registered with the Green Building Council of South Africa (GBCSA). Response data was subjected to descriptive and inferential statistics, namely factor analysis (FA), ANOVA test, and the paired sample test. The benefits of green buildings emanating from the findings were categorised as socio-economic, financial, and health and community benefits. The paired sample test indicated a statistically significant difference between paired samples: financial benefits, health and community benefits, and socio-economic benefits. However, the test revealed no statistically significant difference between financial benefits and socio-economic benefits. There was no statistically significant difference with respect to the perceptions of respondents concerning financial benefits and health and community benefits. It is important to note that the benefits identified in this research may be limited to the time of the research, since the opinions of people relative to green building consciousness and conditions may change over time. It is anticipated that the most significant benefits identified by built environment stakeholders will create an enabling environment to enhance the adoption of green building. Therefore the findings emanating from this study can be used as a support tool for identifying the most significant benefits that enhance the decision of stakeholders to adopt green building and to provide continuous improvement that is essential for green building to gain competitive advantage over the traditional construction methods.

Keywords: Benefits, Built environment professionals, Green building, South Africa

1. INTRODUCTION

In South Africa there is pressure to deliver green building due to environmental issues such as climate changes, the energy crisis, as well as persistent water shortages. Although awareness and promotional efforts have increased drastically concerning the adoption of green buildings, the South African industry is still lagging behind owing to the slow rate of change in the construction industry. The slow rate of adoption of green building is further attributed to misconceptions regarding the benefits of green buildings and the lack of access to cost indications. For this reason, Hwang and Tan (2012) argue that inadequate information and ambiguity relative to the benefits are major obstacles to the development and adoption of green buildings. This notion is supported by Darko et al. (2013) who maintain that there are significant knowledge and data gaps such as lack of empirical information to enable comparisons to be made between conventional and green building costs as well as detailed data with respect to the energy, water and other resource savings arising from green building, and evidence to facilitate investment in financing packages for green building.

Although previous studies (Sundayi et al*.,* 2015; Windapo, 2014; Cruywagen, 2013) have been conducted to analyse the cost benefits of green buildings, the majority limited themselves to direct financial or economic analysis, which assessed only the financial benefits and impact of green building development. Furthermore, the South African built environment has not extensively explored or categorised the benefits of green buildings or the interdependency of the benefits in relation to adoption. The lack of comprehensive information regarding the benefits of green building has been consistently reported by various authors (Naumann et al., 2011; Häkkinen & Belloni, 2011; Kats & Capital, 2003). The lack of evidence and inconsistencies, according to Milne (2012) and Sundayi et al. (2015), are because the South African green building market has not reached enough maturity or yet gained major support from the industry stakeholders. Empirical evidence in a study by Windapo (2014) indicated, on the one hand, that operational cost savings, along with marketing potential and the ability to charge higher rents, are all considered generally important benefits. On the other hand, healthy indoor air quality is almost unanimously considered as unimportant. It is worth noting that the designers and architects in particular pointed out that increased rent and property value are not important benefits of green building (Windapo, 2014). During another study conducted by Sundayi et al. (2015), reduction in operating costs and the cost premium for green implementation were identified as the benefits having the greatest influence regarding the decision to adopt green building projects in South African. The foregoing discussion provides a clear indication of a lack of a suitable classification system for categorising the various benefits of green building in South Africa.

Therefore, the study is aimed at investigating the benefits of green buildings and identifying the benefits regarded as the most important to promote the adoption of green building. The structure of this paper summarises and presents brief discussions with regard to the extant literature relative to the benefits of green building. It provides a brief theoretical underpinning with respect to the perceived attributes of green building, including its relative advantages or benefits. This is followed by the

methodological approach adopted. It is in this context that the factor analysis-based method is used in categorising the benefits of green building, followed by a discussion of the findings. The final section addresses recommendations made, conclusions, and the critical implication and contribution of the paper to knowledge.

2. LITERATURE REVIEW

2.1 Overview of the benefits of green building

Several studies (Park et al., 2014; Castleton et al., 2010; Thatcher & Milner, 2014; Wiley et al., 2010; Ashuri & Durmus-Pedini, 2010) report that green buildings have an enormous advantage over non-green building. Thus green buildings are energy efficient, emit a lesser amount of greenhouse gases, produce less waste, and enhance occupants' productivity and health as well as ensuring higher satisfaction and a lower absenteeism rate. According to Ashuri and Durmus-Pedini (2010), green building is all about promoting well-being, usually as it relates to the environment, health, and community. In addition, there are also tangible economic benefits such as the reduction of energy and water use. Green building also provides other benefits, such as market and industry benefits (Ashuri & Durmus-Pedini, 2010). Nonetheless, Kim et al. (2017) contend that these ingenious benefits come with a high price tag. Empirical evidence is a study conducted by Chegut et al. (2014) to examine the supply, demand and the value of green buildings. The study revealed that tenants occupying green office buildings pay approximately 20% more on rental premiums compared with those who lease non-green buildings (Chegut et al., 2014). Therefore, improving the availability of reliable information and knowledge relative to the benefits of green building would better inform stakeholders and the general public and help to diminish misperceptions (Darko et al., 2013). According to Khoshbakht, Gou and Dupre (2017), the accumulation of diverse cost-benefit variables is imperative for a full package of economic evaluations, and it should be communicated to various stakeholders in the green building industry. Even though the benefits are categorised as environmental, health and community, financial and economic, market, and industry, most of the categories have secondary financial benefits as well (Ashuri & Durmus-Pedini, 2010).

2.2 Environmental benefits

Various authors (Shabrin & Kashem, 2017; Darko et al., 2013; Nurick & Cattell, 2013) were of the view that green buildings' environmental benefit is well recognised. According to Darko et al. (2013), the environmental benefits associated with green building include improved air and water quality; reduced waste; conservation and restoration of natural resources, and protected biodiversity and ecosystems. Similarly, a report compiled by the US Environmental Protection Agency also revealed that green buildings enhance and protect ecosystems, improve air and water quality, decrease waste streams to air and land, and preserve and restore natural and renewable resources (USEPA, 2009). Research conducted by Shabrin and Kashem (2017) also revealed that the environmental aspect of green building is to reduce heat gain, particularly when buildings are designed and oriented to optimise the utilisation of daylight.

2.3 Financial / Economic benefits

Shabrin and Kashem (2017) report that green buildings have numerous economic benefits. The benefits range from the direct to the indirect. Firstly, the direct economic benefits comprise better a payback period for green buildings due to a low consumption of energy, water, and health cost; providing a quick return on investment, and an increase in revenue. Secondly, there is a reduction in operating costs as green building saves money through reduced energy usage, water usage and lower maintenance costs of the building. Thirdly, green buildings have higher building value as it owners and developers can earn higher rents, and enjoy higher occupancy rates than non-green buildings. On the other hand, indirect benefits are firstly, improved internal building conditions which contribute to higher productivity for occupants due to good indoor air quality and thermal comfort of the workplace; and secondly, branding and prestige since green building is a divergent product which is technologically and environmentally advanced and socially liable. Similarly, Darko et al. (2013) opine that the economic benefits of green building include reduced operating costs; the creation, expansion and shaping of markets for green products and services; enhanced productivity of occupants, and optimised economic performance over the building's lifetime. Srinivas (2009) found that green building may significantly contribute to the reduction of power consumption by 20% - 40 % and the reduction of potable water consumption by between 30% - 40%.

2.4 Social benefits

Enhanced comfort and health for occupants and being aesthetically pleasing have been identified as some of the social benefits associated with green building (Darko et al., 2013). According to Khoshbakht et al. (2017), benefits include differing savings and financial gains during building construction and after construction phases such as higher property market value, higher rents, fewer vacancies, marketing opportunities resulting from social benefits, lower carbon taxes, higher energy savings, less sick leave, and higher productivity. Shabrin and Kashem (2017) postulate that the social and community aspects of green building provide more opportunities in terms of job creation for the locals. For example, many jobs will be offered for the reason that green building is a new venture since new generations can undertake research and explore this industry.

2.5 Market and industry benefits

According to Ashuri and Durmus-Pedini (2010), green building tends to bring its own demand to the marketplace; hence, as the numbers of workers occupying green buildings surge, their greater levels of satisfaction with their work environment will prompt a demand for similar surroundings from industry peers. Consequently, this will create a positive feedback loop within the marketplace that will complement the financial, environmental and health benefits (Ashuri & Durmus-Pedini, 2010). The benefits with respect to market aspects include the creation of value within the compatible market, higher occupancy rates, fewer vacancy periods, meeting of growing demands by tenants, company recognition, and lower advertising costs (Ashuri & Durmus-Pedini, 2010). Moreover, Ashuri and Durmus-Pedini (2010) opine that the industry benefits associated with green building include creating a

positive impact on the construction industry; allowing technology to become part of the green building process; improving the outcome of projects; professionals becoming more qualified, educated, and integrated; allowing openings for other countries and selling green building know-how; other industries benefitting from new opportunities apart from the building sector benefit; helping to create and increase job opportunities, and enabling eligibility for grant money.

2.6 Other benefits

It is important to note that in addition to the specific benefits, there are other benefits of green building. These benefits include opportunities for research and development in the green building field, more tax revenue for the government (Shabrin & Kashem 2017), and climate change-related benefits (USEPA, 2014). With respect to research and development, Shabrin and Kashem (2017) state that researchers will always find a way to make the necessary improvement for the building. In addition, researchers will focus on the greenhouse effect as this will cause harm to the environment in the long term. Relative to the government aspect, the job opportunities that have been offered by the green building will increase the number of employees within a particular area. The government can earn more tax revenue from the employees and corporates (Shabrin & Kashem, 2017). Regarding climate change-related benefits, green infrastructure vegetation assists in the reduction of the amount of atmospheric CO2 through direct carbon sequestration, reductions in water and wastewater pumping and treatment and the associated energy demands, and reductions in building energy use (USEPA, 2014).

3. THEORETICAL UNDERPINNINGS: PERCEIVED ATTRIBUTES OF GREEN BUILDING

Construction innovation researchers have often noted the importance of the diffusion of innovation frameworks and models (Larsen, 2005; Koebel, 2007; Sargent et al., 2012). Innovation diffusion theory examines how the perceived attributes of the innovation, type of innovation decisions, communication channels, time, and social systems interact for the adoption of a new idea, concept or technology in a given adopter market (Mollaoglu et al., 2016). In the context of the study, the green building sector can be seen as a new adopter market. The attributes of the innovation that influence the adoption decision have been well documented in the literature. According to Dearing (2009), an attribute is a perceived characteristic of an innovation. Rogers' (1995) work suggests five central factors, namely observability, trialability, relative advantage, complexity, and compatibility. Together these attributes relate to the adopters' ability to see, touch, try, compare, and understand the innovation in their market context. An array of literature confirms the role each attribute plays in the adoption decision (Greenhalgh et al., 2004). Rogers (2003) postulates that in particular, relative advantage, simplicity, and an innovation's compatibility with a potential adopter's or organisation's norms and procedures account for considerable variance in explaining adoption decisions. The other two attributes, namely observability and trialability, are not as consistently important across innovation types for producing adoption. It is reasonable to assume

that for high risk, expensive, and obtrusive innovations, trialability should be especially important whereas for complex innovations which entail many process steps and those innovations that embed high degrees of ambiguity or tacit knowledge in their operation, visibility of the innovation in process and observability of outcomes should be especially important.

Yudelson (2005) contends that of these five attributes, relative economic advantage is considered as the major driver of response to innovation such as green building. The extent of relative advantage is often expressed as economic profitability, social prestige, or other benefits (Rogers, 1995). If adoption of innovation is to be realised, then innovation typically has to make economic sense or have a business advantage over existing ones (Yudelson, 2005). However, the relative advantage of green buildings has yet to be shown in either of these markets, given the demonstrably higher investment costs and certainly higher certification costs, as well as the risks of unforeseen costs compared with conventional building (Häkkinen & Belloni, 2011). Edwards (2003) found that green buildings do pay in the long term. The benefits seem greater for long-term owner-occupants of buildings: however, it is worth noting that many of the reported and putative benefits such as increased employee productivity, reduced absenteeism, improved morale, and health and safety of the building's occupants are soft costs that are difficult to measure or evaluate (Srinivas, 2009; Furr, 2009). In similar vein, Yudelson (2005) states that anecdotal evidence of benefits is strongly in favour of green buildings, but it has not yet filtered through sufficiently to the general marketplace to overcome perceived cost hurdles. Since the green building market is project-based, it may take some time for perceived benefits to find appropriate projects for a fuller implementation. Hence the benefits of green building currently have relatively little acceptance among building owners, developers, and project financiers. In view of the current state of the market, building owners' and developers' requirements for more independent cost and performance appraisals of green buildings are important for building credibility and overcoming perceived barriers. According to "Yudelson's Law" for new products, the anticipated real benefits of the innovation must exceed the likelihood of increased costs by 25% or more to change most decisions in favour of new technologies or methods (Yudelson, 2005: 3).

4. RESEARCH METHODOLOGY

The research method for this study is explained in terms of the research measurement instrument, sampling procedure and size, data collection and analysis techniques. The aim is to investigate the benefits of green buildings and identify the benefits regarded as the most important to promote the adoption of green building in South Africa.

The study hypothesises that:

H1: There is no statistically significant difference between the mean rankings of construction and consultant team members' perceptions on the importance of benefits of green building that enhance the adoption of green building, and

H2: There is no statistically significant difference in agreement of respondents according to their professions and for all identified benefits of green building that

enhances the adoption of green building.

4.1 Measurement instrument

The questionnaire was divided into three sections as follows:
General demographics of the respondents;
Respondents' involvement with green building, and
Respondents' opinions concerning the benefits associated with green building.

The respondents were asked to rate the benefits they perceived as important in enhancing the adoption of green building on a five-point Likert-scale (1 = minor extent, 2 = a near minor extent, 3 = to some extent, 4 = near to a major extent, and 5 = a major extent)

4.2 Sampling procedure and size

The technique of probability (simple random sampling) sampling was employed for this study. The population of the survey was limited to the green building council database for accredited green building professionals in both public and private sectors. The professionals included architects and designers, consulting engineers (electrical, civil, mechanical and structural), developers, environmental and sustainable consultants, facility managers, quantity surveyors, green building consultants, project managers, and general contractors (GCs). The sampling frame for the research was limited to four provinces given that most (99%) of the GBCSA accredited professionals were from the four provinces as indicated in Table 1.

Table 1: Sample frame of accredited GBCSA professionals from the four provinces

Province	No.	Percentage
Eastern Cape	40	3.2
Gauteng	758	60.8
KwaZulu-Natal	88	7.1
Western Cape	360	28.9
Total	1 246	100.0

Following the research population in Table 1, it would have been impossible to obtain data from all the targeted populations owing to time and cost constraints; hence, sampling is essential for the questionnaire survey to have a size that will be representative of the population being studied. To determine a suitable representative sample, the formula from Czaja and Blair (2005) was applied:

$$ss = \frac{z^2 \times p(1-p)}{c^2}$$

where:
ss = sample size
z = standardised variable
p = percentage picking a choice, expressed as a decimal
c = confidence interval, expressed as a decimal

From the above formula, the survey sample was determined to be approximately 445 built environment professionals. Based on the calculated sample size, a random selection of professionals was made from the GBCSA database to provide a list of 445 participants for the survey.

4.3 Survey administration and data collection

The targeted GBCSA professionals in the selected four provinces were invited via email to take part in the study. A web-based survey was adopted owing to the geographical spread of the professionals and firms involved in the study (Saunders et al., 2009). The survey instrument with a supplementary personalised, signed cover letter was sent to the 445 survey participants through e-mail. It is important to note that out of 445 sent e-mails, 419 (94%) were delivered and 26 (6%) were not delivered. Out of the 419 e-mails delivered to respondents, 106 were duly completed and returned using a web survey, hence an overall response rate of 25% was achieved.

4.4 Data analysis techniques

The data analysis technique comprised both descriptive and inferential statistical methods. Descriptive statistics were used to measure the central tendency such as mode, median and mean, and the dispersion (standard deviation) of the data. Inferential statistics were used to validate the data collected through the paired sample t-test and analysis of variance (ANOVA), as well as factor analysis. The Statistical Package for Social Scientists (SPSS) and Microsoft Excel for Windows were used for capturing and computing relevant analyses of the data.

5. FINDINGS AND DISCUSSION

5.1 Demographic data

This section presents an overview of the demographical data received, namely (1) qualification; (2) occupation or profession; (3) experience of respondents (4) age; (5) gender; and (6) number of green projects executed.

Highest formal qualification

Table 2 indicates the various academic qualifications within the population response group. It is important to note that approximately 83% of respondents had tertiary learning qualifications, including national diplomas (19.8%) BTech or bachelors' degrees (23.6%), BSc (Hons) degrees (21.7%), masters' degrees (17.0%), and doctoral degrees (0.9%). This suggests respondents had the relevant educational background to understand and respond appropriately to the survey. Moreover, a large portion of the sample consisted of holders of bachelors' degrees, followed by BSc (Hons) degrees and national diploma holders.

Table 2: Highest formal education achieved by respondents

Qualification	Frequency	Percentage
Matric certificate	2	1.9
National diploma	21	19.8
BTech / BSc	25	23.6
BSc (Hons)	23	21.7
MSc / MTech	18	17.0
PhD / DTech	1	0.9
Other	16	15.1
Total	106	100.0

Occupation / profession

Table 3 depicts the occupations of the respondents. The survey population included construction professionals and other stakeholders within the South African built environment. More or less equal portions of the sample consist of architects and designers (23.8%), followed by consulting engineers (22.9%) and environmental, sustainability or green building consultants (21.0%). This result has shown that the respondents surveyed represent a broad spectrum of different professions across the built environment.

Table 3: Occupation of the respondents

Occupation	Frequency	Percentage
Architects / designers	25	23.8
Consulting engineering (civil, mechanical, electrical, structural)	24	22.9
Developer / client / owners	2	1.9
Environmental / sustainable / green building consultants	22	21.0
Facility manager	7	6.7
Quantity surveyor / cost consultant	8	7.6
Project manager	17	16.2
Total	105	100.0

Experience, age and gender of respondents

Results as depicted in Table 4 indicate that the majority of respondents (41.5%) have between two to five years of experience in their current position. Most of the respondents in the construction industry have experience of over five years distributed as between six to ten years (26.4%) and over 10 years (37.7%). Regarding the age group, the majority of the respondents (32.4%) were aged between 31 and 40 years, 27.6% were aged between 25 and 30 years, and 21.0% were aged between 41 and 50 years: this suggests that the respondents were mature. With regard to gender, 64% (68) of the respondents were males and 36% (38) were females, and this suggests both genders participated in the study but were not equally represented. In addition, the descriptive analysis revealed that the majority of respondents (53.8%) have executed between two to five green building projects, and the rest as indicated by respondents are fairly evenly distributed across the groups. The results are

presented in Table 4.

Table 4: Age, experience and gender of respondents

Variable	Frequency	Percentage
Experience in current position		
0 – 1 years	21	19.8
2 – 5 years	44	41.5
6 – 10 years	24	22.6
Over 10 years	17	16.1
Total	**106**	**100.0**
Experience in the construction industry		
0 – 1 years	16	15.1
2 – 5 years	22	20.8
6 – 10 years	28	26.4
Over 10 years	40	37.7
Total	**106**	**100.0**
Age group of respondent		
Under 25 years	7	6.7
25-30 years	29	27.6
31-40 years	34	32.4
41-50 years	22	21.0
51-60 years	10	9.5
Over 60 years	3	2.9
Total	**105**	**100.0**
Gender		
Male	68	64.0
Female	38	36.0
Total	**106**	**100.0**
Number of green building projects performed		
0 – 1 projects	13	16.7
2 – 5 projects	42	53.8
6 – 10 projects	11	14.1
Over 10 projects	12	15.4
Total	**78**	**100.0**

In the past have you worked or are you currently working on a green building project?

The descriptive analysis revealed that most of the respondents (78.3%) have been or are currently involved in green build projects, 20.8% answered in the negative, while 0.9% were unsure. This suggests that the majority of the respondents have hands-on experience with regard to green building.

5.3 Benefits of green building that enhance the adoption of green building

The results as shown in Table 5 indicate the extent to which the benefits associated with green buildings enhance the decision to adopt green building in terms of percentage responses in a range of 1 (minor) to 5 (major), and a MS with a minimum value of 1.00 and a maximum value of 5.00. It is evident that 27 of the 30 (90%) MSs are above the midpoint score of 3.00, which indicates that in general the respondents can be deemed to perceive that the 27 benefits associated with green buildings could influence stakeholders' decisions to a major extent as opposed to a minor extent in terms of adopting green building in the South African market. The top four out of 30 (13.3%) MSs are > 4.20 ≤ 5.00, which indicates that these benefits could influence stakeholders'decisions from a near major extent to a major extent. The hierarchy further indicates that 'green building reduces energy and water consumption' is ranked first, followed by 'reduces operational costs', 'enhances the value and profitability of assets' is ranked third, and 'reduces life cycle energy costs' is ranked fourth, which are imperative in terms of building a sound business case for the adoption of green building.

The descriptive analysis further indicates that 16 out of 30 (53.3%) MSs are > 3.40 ≤ 4.20, which indicates that the contribution of these benefits to enhancing the adoption of green building can be deemed to be between some extent to a near major extent. 'Company recognition', 'higher occupancy rate', 'creating value within the compactible market', and 'meeting growing demands by tenants' ranked fifth, ninth, twelfth, and fourteenth respectively: all are market-related benefits that can influence the adoption of green building. 'Optimises life cycle economic performance', 'higher rental growth', and 'longer economic life of the facility' ranked sixth, sixteenth, and nineteenth respectively: all are financial-related benefits that augment the adoption of green building. The benefits 'enhances occupant comfort and health', 'improves water and indoor air quality', and 'improves employee productivity and satisfaction', are ranked seventh, eighth, and tenth respectively. In addition, 'lowers greenhouse gas emissions', 'contributes to the overall quality of life', and 'improves thermal, daylight and acoustic environments', ranked eleventh, thirteenth, and fifteenth respectively. Furthermore, 'conserves natural resources', 'enhances and protects the eco-system' and 'reduces solid waste' are ranked seventeenth, eighteenth, and twentieth respectively, and are all environmental-related benefits that promote the adoption of green building. 'Longer economic life of the facility', which is ranked nineteenth, is primarily a financial-related benefit.

Table 5: Relative advantages / benefits of green buildings

Benefit	Unsure	Response (%) Minor...……Major					MS	SD	Rank
		1	2	3	4	5			
Reduces energy and water consumption	1.9	0.0	0.0	4.7	23.6	69.8	4.58	0.85	1
Reduces operational costs	1.9	0.0	3.8	8.5	22.6	63.2	4.40	1.01	2
Enhances the value and profitability of assets	2.8	0.0	0.9	10.4	31.1	54.7	4.31	1.03	3
Reduces life cycle energy costs	4.7	0.9	2.8	11.3	20.8	59.4	4.21	1.28	4

Company recognition	1.9	0.9	0.9	13.2	37.7	45.3	4.20	0.99	5
Optimises life cycle economic performance	1.9	1.9	4.7	16.0	33.0	42.5	4.04	1.12	6
Enhances occupant comfort and health	1.9	0.0	9.4	14.2	34.9	39.6	3.99	1.11	7
Improves water and indoor air quality	1.9	0.9	5.7	18.9	34.9	37.7	3.97	1.09	8
Higher occupancy rate	4.7	0.0	2.8	19.8	33.0	39.6	3.95	1.21	9
Improves employee productivity and satisfaction	2.8	0.0	6.6	18.9	34.0	37.7	3.94	1.14	10
Lowers greenhouse gas emissions	1.9	2.8	9.4	17.0	30.2	38.7	3.87	1.22	11
Creates value within the compactible market	6.6	0.0	2.8	17.0	39.6	34.0	3.85	1.29	12
Contributes to the overall quality of life	1.9	0.0	10.4	18.9	40.6	28.3	3.81	1.08	13
Meets growing demands by tenants	4.7	0.0	6.6	20.8	34.0	34.0	3.81	1.24	14
Improves thermal, daylight and acoustic environments	2.8	1.9	7.5	23.6	28.3	35.8	3.80	1.22	15
Higher rental growth	10.4	1.9	5.7	5.7	32.1	44.3	3.80	1.59	16
Conserves natural resources	0.9	5.7	9.4	23.6	25.5	34.9	3.72	1.25	17
Enhances and protects the eco-system	1.9	3.8	11.3	24.5	23.6	34.9	3.69	1.27	18
Longer economic life of the facility	4.7	4.7	8.5	18.9	30.2	33.0	3.64	1.39	19
Reduces solid waste	4.7	4.7	11.3	27.4	17.0	34.9	3.52	1.43	20
Positive impact on the construction industry	2.8	7.5	17.0	23.6	28.3	20.8	3.29	1.33	21
Reduction in the cost of refurbishment	10.4	6.6	13.2	18.9	21.7	29.2	3.23	1.64	22
Allows professionals to become more qualified, educated, and integrated	4.7	9.4	14.2	26.4	23.6	21.7	3.20	1.42	23
Lowers health-related costs such as insurance premiums	7.5	7.5	17.0	26.4	15.1	26.4	3.13	1.54	24
Reduction in property taxes and insurance rates	14.2	9.40	11.3	17.0	17.0	31.1	3.07	1.79	25
Helps to create job opportunities in the construction industry	7.5	10.4	14.2	27.4	21.7	18.9	3.02	1.49	26
Helps other industries to benefit from new opportunities	5.7	12.3	15.1	26.4	24.5	16.0	3.00	1.43	27
Creates collaboration between other countries and selling green building know-how	5.7	12.3	19.8	19.8	27.4	15.1	2.96	1.45	28
Lowers litigation risks because of improved indoor air quality	12.3	19.8	13.2	17.0	13.2	24.5	2.73	1.76	29
Lowers advertising costs	13.2	13.2	17.9	22.6	19.8	13.2	2.62	1.58	30

The remaining 10 out of 30 (33.3%) MSs are > 2.60 ≤ 3.40, indicating that respondents' agreement can be deemed to be between a near minor extent to some extent and some extent for the following benefits: 'positive impact on the construction industry'; 'reduction in the cost of refurbishment'; 'allows professionals to become more qualified, educated, and integrated'; 'lowers health-related costs such as insurance premiums'; 'reduction in property taxes and insurance rates'; 'helps to create job opportunities in the construction industry'; 'helps other industries to benefit from new opportunities'; 'creates collaboration between other countries and selling green building know-how'; 'lowers litigation risks because of improved indoor air quality', and 'lowers advertising costs'.

5.4 Identifying the underlying structure of benefits of green building using factor analysis

In total, 30 benefits of green building were evaluated in the study. To condense the number of variables to enable subsequent analyses, and also to test the factor structure of the 30 benefits associated with green building, factor analysis was undertaken. It was also an opportunity to assess the convergent and discriminant validity of the benefits. A principal component analysis (PCA) was adopted as the method of extraction. To extract the underlying components, all thirty items pertaining to benefits of green building loaded together on this factor and Kaiser's criterion using eigenvalues was adopted. Oblimin rotation was used to extract the variables that load on each identifiable component. Prior to performing PCA, the Kaiser-Meyer-Olkin test and Bartlett's test of sphericity were conducted to assess the suitability of data for factor analysis. These two statistical measures provide the minimum standard that the data should meet to be considered adequate for factor analysis. Pallant (2012) and Tabachnick and Fidell (2012) maintain that the value of the KMO ranges between 0 and 1, with 0.60 suggested as the minimum value for good factor analysis. The Bartlett test indicates the strength of the relationship among variables and a significant level of Bartlett's test is a requirement for the data to be considered suitable for analysis. The level of significance for Bartlett's test should be $p<0.05$ for FA to be considered appropriate (Field, 2013). The dataset was suitable as the KMO value was 0.899, exceeding the recommended value of 0.6 and Bartlett's test of sphericity was statistically significant at $p=0.000$ ($p<0.05$). The PCA uncovered five components under this category with eigenvalues greater than 1, and the five factors accounted for 73.45% of the total variance of the thirty benefit criteria. A careful assessment of the scree plot revealed a clear break after the fifth component. The Monte Carlo PCA for parallel analysis was performed to ascertain which components to retain. The result of the parallel analysis is presented in Table 7. The criterion eigenvalues of the first five components are 12.868, 3.698, 2.472, 1.679 and 1.319. On the other hand, the corresponding random eigenvalues obtained from the parallel analysis are 2.1578, 1.9792, 1.8439, 1.7296 and 1.6350 for components 1,2,3,4 and component 5 respectively. It is apparent in Table 6 that only three components could be retained since their eigenvalues are greater than the parallel analysis randomly generated eigenvalues. However, it should be noted that the fourth and fifth components are rejected, given that their eigenvalues are less than the random eigenvalues of the parallel analysis.

Table 6: Comparison of PCA eigenvalue with parallel analysis eigenvalue

Component number	Actual eigenvalue from PCA	Random eigenvalue from parallel analysis	Decision
1	12.868	2.1578	accept
2	3.698	1.9792	accept
3	2.472	1.8439	accept
4	1.679	1.7296	Reject
5	1.319	1.6350	Reject

Hence three components were retained based on the results of the parallel analysis. For this reason, the three-component solution was accepted and the analysis was re-run extracting three components. These three components extracted accounted for 63.458 % of the total variance in the 30 dimensions of benefits associated with green building. The Oblimin rotation was adopted to aid in the interpretation of these three components. The results as depicted in Table 7 revealed the three components showing a number of loadings above 0.3 on both pattern matrix and structure matrix on the three components. The communalities values as shown in Table 7 also indicate that the variables fit well into the component with all the variables having above 0.3, which indicates that there was a positive correlation between the three components. Considering the loading pattern of benefits of green building, the variables that converge on component 1 represent 'socio-economic benefits', on component 2 represent 'financial benefits' and component 3 was named 'health and community benefits'.

Table 7: Pattern and structure matrix for benefits of green building

Variables	Pattern Matrix Coefficient Component			Structure Matrix Coefficient & Component			Communalities
	1	2	3	1	2	3	
MB8 - Creates collaboration between other countries & selling green building know-how	.816			.830		.372	.663
MB6 - Positive impact on the construction industry	.812			.830	.392	.301	.671
EB6 - Conserves natural resources	.810			.823		.357	.702
EB1 - Enhances and protects the eco-system	.800			.819			.609
MB9 - Helps other industries to benefit from new opportunities	.791			.801			.722
MB7 - Allows professionals to become more qualified, educated, and integrated	.787			.778			.686
EB4 - Lowers greenhouse gas emissions	.706			.768	.420	.409	.560
MB10 - Helps to create job opportunities in the construction industry	.688	.301		.750	.466		.642
EB5 - Reduces solid waste	.675			.741		.701	.650

EB2 - Improves water and indoor air quality	.618		.385	.737		.364	.648
EB9 -Contributes to the overall quality of life	.589		.538	.725		.568	.788
FB7 - Reduction in property taxes and insurance rates		.872		.302	.871		.770
FB8 - Higher rental growth		.829			.828	.333	.711
FB10 - Lowers litigation risks because of improved indoor air quality	.468	.690		.602	.770		.779
FB6- Longer economic life of the facility		.671		.495	.768	.396	.654
FB5- Lowers health-related costs such as insurance premiums		.665		.344	.767	.474	.687
MB2 - Higher occupancy rate		.635	.360		.718	.519	.622
FB9 -Reduction in the cost of refurbishment	.312	.613		.479	.700	.320	.584
MB5 - Lowers advertising costs	.486	.534		.582	.621		.588
MB3 - Meets growing demands by tenants		.489	.351		.601	.506	.472
FB1 - Reduces operational costs		.338	.720		.525	.772	.705
EB3 - Reduces energy & water consumption			.714	.689		.762	.504
FB3 - Enhances the value and profitability of assets		.465	.653	.363	.544	.757	.747
FB4 - Optimises life cycle economic performance		.327	.632		.629	.743	.678
EB8 - Enhances occupant comfort & health	.507		.630	.586		.714	.802
EB10 - Improves employee productivity and satisfaction	.336		.623	.518		.698	.588
EB7 - Improves thermal, daylight and acoustic environments	.404		.610			.688	.651
FB2 - Reduces life cycle energy costs			.568	.325	.483	.678	.541
MB1 - Creates value within the compactible market			.521			.547	.313
MB4 - Company recognition			.425		.348	.508	.300

Factor 1 - Socio-economic benefits: Based on the inter-correlation, eleven benefits related to socio-economic benefits should be consolidated into an underlying factor. These include 'creates collaboration between other countries and selling green building know-how'; 'positive impact on the construction industry'; 'conserves natural resources'; 'enhances and protects the eco-system'; 'helps other industries to benefit from new opportunities'; 'allows professionals to become more qualified, educated, and integrated'; 'lowers greenhouse gas emissions'; 'help to create job opportunities in the construction industry'; 'reduces solid waste'; 'improves water and indoor air quality', and 'contributes to the overall quality of life'. These findings are related to the normative literature reported by Darko et al. (2013), Khoshbakht et

al. (2017) and Shabrin and Kashem (2017).

Factor 2 - Financial benefits: The financial benefits include nine factors: 'Reduction in property taxes and insurance rates'; 'higher rental growth'; 'lowers litigation risks because of improved indoor air quality'; 'longer economic life of the facility'; 'lowers health-related costs such as insurance premiums'; 'higher occupancy rate'; 'reduction in the cost of refurbishment'; 'lowers advertising costs', and 'meets growing demands by tenants'. These findings are supported by those of Shabrin and Kashem (2017), Srinivas (2009) and Darko et al. (2013).

Factor 3 - Health and community benefits: 'Reduces operational costs', 'reduces energy and water consumption', 'enhances the value and profitability of assets', 'optimises life-cycle economic performance', 'enhances occupant comfort and health', 'improves employee productivity and satisfaction', 'improves thermal, daylight and acoustic environments', 'reduces life cycle energy costs', 'creates value within the compatible market', and 'company recognition' were grouped under the aforementioned factor based on the analysis. These findings are consistent with the findings of previous studies related to health and community benefits (Yudelson, 2008).

5.5 Perception with respect to the importance of the benefits of green building

H1: Ranking the importance of the benefits of green building

A paired sample test was performed to test the following hypothesis:
H1: There is no statistically significant difference between the mean rankings of construction and consultant team members' perceptions on the importance of benefits of green building that enhance the adoption of green building.
Prior to performing the paired T-test, the test of reliability of scale of benefits of green building was undertaken. Table 8 presents the results of the test of reliability for benefits of green building that enhance the adoption of green building. It is worthy to note that the study produced highly reliable measures ranging from 0.89 to 0.941.

Table 8: Test of reliability of benefits of green building

Factors	Number of items	Cronbach's alpha coefficient	Comments
Socio-economic benefits	11	0.941	Highly reliable
Financial benefits	9	0.916	Highly reliable
Health and community benefits	10	0.890	Highly reliable

Test of mean ranking and paired sample test on benefits of green building

Table 9 depicts the hierarchical ranking of the importance of the benefits of green building that enhance the adoption of green building. It is evident that 'health and community benefits' had the highest mean score of 4.13. In addition, a paired sample statistic test was performed to assess the statistical significance difference between the perceived benefits of green building and the effect of size. It is evident from Table 10 that a statistically significant difference between the following paired samples was revealed: financial benefits and health and community benefits, and health and community benefits and socio-economic benefits since p= 0.000. On the other hand, the analysis revealed no statistically significant difference between financial benefits and socio-economic benefits. The eta squared ranged from small (0.01) to large size effect (0.42). The significance difference between financial benefits and health and community benefits, and health and community benefits and socio-economic benefits is a signal that something is operating below the surface of the statistic and merits further attention and investigation (Leedy & Ormrod, 2010). Therefore, the null hypothesis stating that there is no significant difference between the mean rankings of built environment professional's perception regarding the benefits of green building can either be accepted or rejected.

Table 9: Benefits of green building

Benefits of green building	No	Mean	SD	Rank
Health and community benefits	106	4.1311	0.78708	1
Socio-economic benefits	106	3.4588	1.04796	2
Financial benefits	106	3.3312	1.19069	3

Table 10: Paired sample test on attributes of adopters

		Paired Differences								
					95% CI of the					Eta
				Std. Error	Difference				Sig.	squared
		Mean	Std. Dev.	Mean	Lower	Upper	t	df	(2-tailed)	
Pair 1	FB - HCB	-0.800	0.946	0.092	-0.982	-0.618	-8.707	105	.000	0.42
Pair 2	FB - SEB	-0.128	1.065	0.103	-0.333	0.077	-1.234	105	.220	0.01
Pair 3	HCB - SEB	0.672	0.851	0.083	0.508	0.836	8.137	105	.000	0.39

Keys: FB: Financial benefit; HCB: Health and community benefits; SEB: Socio-economic benefit

H2: Discussions with regard to agreement of built environment professionals and benefits of green building

The one-way between-groups ANOVA was carried out to examine the following hypothesis:

H2: There is no statistically significant difference in agreement of respondents according to their professions and for all identified benefits of green building that enhance the adoption of green building.

Table 11 presents a summary of the ANOVA test relative to the agreement of respondents according to their professions and the benefits of green building. It is imperative to note that there is a statistically significant difference across the different built environment professionals regarding socio-economic benefits. A post-hoc test was deemed necessary to establish the difference in perceptions amongst the different built environment professionals concerning the social-economic benefits of green building. In the results presented in Table 12, post-hoc comparisons using the Tamhane test indicate that only consulting engineers and facility managers are statistically significantly different from each another. In effect, consulting engineers' and facility managers' perceptions in terms of the socio-economic benefits differ significantly. However, there was no statistically significant difference in the agreement of respondents according to their professions and financial and health and community benefits since the significance level is $p>0.05$. Therefore, the null hypothesis stating that there is no statistically significant difference in the agreement of respondents according to their professions and for all identified benefits of green building that enhance the adoption of green building is partially supported.

Table 11: ANOVA on Built environment professionals and benefit of green building

Due to different professional backgrounds					
Benefits	Sum of Squares	df	Mean Square	F	Sig.
Socio-economic benefits					
Between groups	15.108	6	2.518	2.509	0.027
Within groups	98.339	98	1.003		
Total	113.447	104			
Financial benefits					
Between groups	16.340	6	2.723	2.021	0.070
Within groups	132.072	98	1.348		
Total	148.412	104			
Health and community benefits					
Between groups	7.399	6	1.233	2.101	0.060
Within groups	57.511	98	.587		
Total	64.910	104			

Table 12: Tamhane post-hoc test on built environment professionals' perceptions and socio-economic benefits

(I) To which category do you belong?	(J) To which category do you belong?	Mean Diff. (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Consulting engineering (mechanical, electrical, civil, structural)	Architects / designers	-0.310	0.300	1.000	-1.275	0.655
	Developer / client / owners	-1.712	0.287	0.279	-5.366	1.941
	Environmental / sustainable / green building consultants	-0.348	0.265	0.990	-1.203	0.506
	Facility manager	-1.225*	0.302	0.030	-2.364	-0.087
	quantity surveyor / cost consultant	-0.064	0.528	1.000	-2.281	2.152
	project manager	-0.736	0.267	0.176	-1.608	0.136
	project manager	0.976	0.304	0.638	-1.829	3.780
Facility manager	Architects / designers	.915	0.346	0.290	-0.296	2.125
	Consulting engineering (mechanical, electrical, civil, structural)	1.225*	0.302	0.030	0.087	2.364
	Developer / client / owners	-0.487	0.335	0.995	-2.857	1.883
	Environmental / sustainable / green building consultants	.877	0.317	0.267	-0.282	2.035
	Quantity surveyor / cost consultant	1.161	0.556	0.745	-1.064	3.386
	Project manager	0.489	0.318	0.964	-0.679	1.658

*. The mean difference is significant at the 0.05 level.

6. PRACTICAL IMPLICATIONS AND CONTRIBUTION TO THE BODY OF KNOWLEDGE

Green building represents a different kind of construction practice, hence in addressing the changes in built environment, stakeholders require new techniques to understand and promote its adoption. The adoption of green building projects not only involves a change in mind-set and the kinds of practices employed but also involves changes for built environment stakeholders. It is important to note that if green building remains a niche area, the detrimental environmental effects of building construction will not be sufficiently reduced. Compared to previous empirical studies in the South African context, the knowledge gap included the lack of evidence in terms of a suitable system for categorising the benefits of green building. Furthermore, the statistically significant differences concerning the perceptions of built environment professionals regarding the mean rankings of the benefits that enhance the adoption of green building are not evident.

Thus, this research has contributed to existing knowledge by developing a suitable system for categorising the benefits of green building which can be valuable in bringing green building into the mainstream as the non-availability of such a system is a major barrier in the growth of the green building movement. Therefore, the findings emanating from this study can be used as a support tool for identifying the most significant benefits that enhance the decision of stakeholders to adopt green building and to provide continuous improvement that is essential for green building to gain competitive advantage over the traditional construction methods. The categorisation system for the benefits of green building has considerable potential to broaden the understanding of stakeholders who engage in green building and to accelerate the implementation of the green building concept in construction. Moreover, clients or developers and other built environment stakeholders should not overlook the relative advantages of green building such as health and community benefits, socio-economic benefits and most importantly, financial benefits in terms of adopting green building.

7. CONCLUSION AND RECOMMENDATION

The aim of the study was to investigate the benefits of green buildings and identify which benefit is regarded as the most important to promote the adoption of green building. In total, 30 benefits were evaluated in the study. The descriptive statistic revealed that out the 30 factors identified, 27 had mean scores above the midpoint score of 3.00. This implies that these factors will contribute to more of a major as opposed to a minor extent in influencing stakeholders' decision to adopt green building. Further analysis of the results was conducted using PCA. Based on the PCA results, the benefits were categorised as 'socio-economic', 'financial', and 'health and community benefits'. A paired sample test was performed to ascertain whether there is any statistically significant difference between the mean rankings of construction and consultant team members' perceptions with respect to the importance of the benefits of green building. The paired sample test indicated a statistically significant difference between paired samples: financial benefits and health and community benefits, and health and community benefits and socio-economic benefits. On the other hand, the analysis revealed no statistically significant difference between financial benefits and socio-economic benefits. As such, the hypothesis stating that there is no significant difference between the mean rankings of built environment professional's perception regarding the benefits of green building can either be accepted or rejected.

The one-way between-groups ANOVA was carried out to examine whether there is any statistically significant difference in the agreement of respondents according to their professions and for all identified benefits of green building. There are no statistically significant differences in the perception of financial benefits and health and community benefits necessary to enhance the adoption of green building among the different groups. This implies that construction professionals within the South African built environment, irrespective of the sector (clients, consultants or contractors) where they work, generally have similar opinions regarding the financial, and health and community benefits influencing the adoption of green building. But

the statistical analysis revealed a statistically significant difference across the different built environment professionals regarding the socio-economic benefits. As such, the hypothesis that there is no statistically significant difference in agreement of respondents according to their professions and for all identified benefits of green building is partially supported.

Based on the findings of this study discussed in the aforementioned sections, it is recommended that further studies should focus on the following:

To investigate and identify professionals' perception of the importance of performance indicators for assessing or measuring the benefits of green building;

To test the statistically significant difference between groups based on adopter categories and the benefits of green building; and

To evaluate the actual post-occupancy performance of the buildings with the purpose of comparing actual operating data of green-rated buildings to the other buildings (e.g. 4 star versus 5 star) as well as non-green buildings.

8. REFERENCES

Ashuri, B. & Durmus-Pedini, A. (2010). An overview of the benefits and risk factors of going green in existing buildings. *International Journal of Facility Management*, 1(1).

Castleton, H. F., Stovin, V., Beck, S. & Davison, J. B. (2010). Green roofs: Building energy savings and the potential for retrofit. *Energy and Buildings*. 42(10): 1582–91.

Chegut, A., Eichholtz, P. & Kok, N. (2014). Supply, demand and the value of green buildings. *Urban Studies*, 51(1): 22–43.

Cruywagen, J. H. (2013). The cost of "going green" – A case study. In: *Proceedings of 6th Annual SACQSP Research Conference on Green Vision 20/20,* Cape Town, South Africa, 20 – 21 June.

Czaja, R. & Blair, J. (2005). *Designing surveys. A guide to decisions and procedures*, (2nd ed.). Thousand Oaks, California: Sage Publications.

Darko, E., Nagrath, K., Niaizi, Z., Scott, A., Varsha, D. & Vijaya Lakshmi, K. (2013). *Green building: Case study*. Overseas Development Institute.

Dearing, J. W. (2009). Applying diffusion of innovation theory to intervention development. *Research on Social Work Practice*, 19(5): 503-518.

Edwards, B. (2003). *Green buildings pay* (2nd ed.). New York: Spon Press.

Furr, J.E. (2009). *Green building and sustainable development: The practical legal guide*. Chicago: American Bar Association Publishing.

Greenhalgh, T., Robert, G., Macfarlane, F., Bate, P. & Kyriakidou, O. (2004). Diffusion of innovations in service organisations: Systematic review and recommendations. *The Millbank Quarterly*, 82: 581-629.

Häkkinen, T. & Belloni, K. (2011). Barriers and drivers for sustainable building. *Building Research & Information*, 39(3): 239-255.

Hwang, B.G. & Tan, J.S. (2012). Green building project management: Obstacles and

solutions for sustainable development. *Sustainable Development*, 20(5): 335-349.

Kats, G. & Capital, E. (2003). *The cost and financial benefits of green buildings: A report to California's sustainable building task force*. Developed for the Sustainable Building Task Force, California, USA.

Khoshbakht, M., Gou, Z. & Dupre, K. (2017). Cost-benefit prediction of green buildings: SWOT analysis of research methods and recent applications. *Procedia Engineering*, 180: 167-178.

Kim, S., Lim, B.T. & Kim, J. (2017). Tenants' decision to or not to lease green and non-green buildings: A conceptual framework. *Procedia Engineering*, 180: 1551-1557.

Koebel, C.T. (2007). Innovation in homebuilding and the future of housing. *Journal of the American Planning Association,* 74(1): 45–58.

Larsen, G.D. (2005). Horses for courses: Relating innovation diffusion concepts to the stages of the diffusion process. *Construction Management and Economics*, 23(8): 787–92.

Leedy, P.D. & Ormrod, J.E. (2010). *Practical research – Planning and design* (9th ed.). Boston: Pearson Education.

Mollaoglu, S., Chergia, C., Ergen, E. & Syal, M. (2016). Diffusion of green building guidelines as innovation in developing countries. *Construction Innovation*, 16(1): 11 – 29.

Naumann, S., Davis, M., Kaphengst, T., Pieterse, M. & Rayment, M. (2011). *Design, implementation and cost elements of green infrastructure projects*. Final report to the European Commission, DG Environment, Ecologic Institute and GHK Consulting, 1-64.

Nurick, S. D. & Cattell, K. S. (2013). An investigation into the mechanisms driving large property owning organisations to implement green building features. In: *Proceedings of 6th Annual SACQSP Research Conference on Green Vision 20/20,* Cape Town, South Africa, 20 – 21 June.

Park, J.H., Cha, G.W. & Hong, W.H. (2014). The evaluation of energy consumption and CO2 emission on green building certification apartments in Korea. *Applied Mechanics and Materials*, 525: 384-387). Trans Tech Publications.

Rogers, E. M. (1995). *Diffusion of innovations* (4th ed.). New York: Free Press.

Rogers, E. M. (2003). *Diffusion of innovations* (5th ed.). New York: Free Press.

Sargent, K., Hyland, P. & Sawang. S. (2012). Factors influencing the adoption of information technology in a construction business. *Australasian Journal of Construction Economics and Building*, 12: 2, 86.

Saunders, M., Lewis, P. & Thornhill, A. (2009). *Research methods for business students* (5th ed.). Hallow: Prentice Hall.

Shabrin, N. & Kashem, S.B. (2017). A comprehensive cost benefit analysis of green building. In: *Proceedings of 94th IIER International Conference*, Dhaka,

Bangladesh, 1-2 February.
Srinivas, S. (2009). Green buildings – Benefits and impacts. In: *Proceedings of World Academy of Science, Engineering & Technology*, 19-21 March.
Sundayi, S., Tramontin, V. & Loggia, C. (2015). An investigation into the costs and benefits of green building in South Africa. In: *Proceedings of the World Congress on Sustainable Technologies (WCST-2015*), pp.77-82.
Thatcher, A. & Milner, K. (2014). Changes in productivity, psychological well-being and physical well-being from working in a 'green' building. *Work* (Reading, Mass.), 49(3): 381–93.
USEPA. (2014). *The economic benefits of green infrastructure: A case study of Lancaster, PA.* A report developed under EPA Contract No. EP-C-11-009 as part of the 2012 EPA Green Infrastructure Technical Assistance Program – United States Environmental Protection Agency.
USEPA. (2009). *Municipal solid waste generation, recycling, and disposal in the United States: Facts and figures for 2008*. EPA- 530-F-009-021. Washington, D.C. Available online at: www.epa.gov/epawaste/nonhaz/municipal/pubs/msw2008rpt.pdf [Accessed 22 August 2017].
Wiley, J. A., Benefield, J. D. & Johnson, K. H. (2010). Green design and the market for commercial office space. *The Journal of Real Estate Finance and Economics*, 41(2): 228–43.
Windapo, A.O. (2014). Examination of green building drivers in the South African construction industry: Economics versus ecology. *Sustainability,* 6(9): 6088-6106.
Yudelson, J. (2008). *The green building revolution*. Washington, DC.: Island Press.
Yudelson, J. (2005). *Predicting the growth of green buildings using the "Diffusion of Innovations" theory*. Tucson, AZ: Yudelson Associates.

PERFORMANCE MANAGEMENT AS A TOOL FOR PERFORMANCE IMPROVEMENT IN THE MANAGEMENT OF BUILT FACILITIES

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ABSTRACT

Effective operation of functional built facilities required for the performance of the core functions of an organization demands the contextual use of the principle of listening to the voice of customers, through performance assessment, leading to performance improvement. Performance improvement is a critical factor necessary for improved productivity and enhanced customer satisfaction. Many approaches have been developed to achieve this, but the most reliable is through sustained commitment to the principle and activities in the performance management loop. In this study the single case study of qualitative research was adopted; data collection and analysis were achieved using the mixed methods approach. The semi-structured questionnaire complemented with an interview was used to collect the qualitative data and was analysed following the principle of content analysis. The structured questionnaire was used to collect quantitative data from the respondents; analysis of feedback helped in identifying areas of variances, which were discussed in a focus group session before developing performance improvement strategies. The findings revealed that subjecting performance assessment results to further analysis helps to identify the areas of latent discontent, which should be resolved before developing performance improvement strategies. Successful operation of the built facilities available for the execution of the core functions of any organization requires the active collaboration between the unit responsible for the operation and maintenance and those responsible for the execution of the core functions. This synergy is required for sustained performance improvement and customer satisfaction requires commitment to the periodic repetition of the activities in the performance management loop.

Keywords: Built facilities, Customer satisfaction, Performance assessment, Performance improvement, Performance management loop

1. INTRODUCTION

During the life cycle of a built facility, the pleasure, client and end-users' satisfaction, aesthetics, and functionality of the edifice gradually begin to wane as the component parts of the structure start deteriorating (Jafari & Makin, 2015; Dziadosz & Meszek, 2015). In order to keep the built facility in a good functional state to meet the needs of the organization, a deliberate maintenance plan must be put in place (in both short and long terms) for regular maintenance of the structure and its components. Maintenance should include repair, routine, scheduled or planned maintenance, renovation and rehabilitation planned into the life cycle of the built facility (Fraser, 2014; Douglas, 2016). Unfortunately, the common practice in many organizations is breakdown maintenance, and occasional renovation and rehabilitation (Kennedy, 2008; Fraser, 2014). It is imperative therefore to sensitize the operatives in the unit responsible for the operation and maintenance of the facilities in the built environment (commonly known as a facilities management (FM) unit) of the organization to embrace the culture of performance management (Amaratunga & Baldry, 2002; Myeda & Pitt, 2012).

Effective management of the facilities in the built environment requires the use of suitable performance measurement tools, periodic performance assessment of operations, harnessing feedback from assessments and developing performance improvement strategies. The consistent commitment to and repetition of this process are commonly referred to as performance management. In the majority of situations, these phenomena are treated separately, instead of being integrated into one study or practice (Melnyk et al., 2014; Lavy et al., 2014). The terms 'performance measurement' and 'performance assessment' are sometimes used interchangeably in literature. However, there are observable differences between them; the former provides a set of standards against which actual operation is measured (Amaratunga & Baldry, 2002), while the latter evaluates the actual performance against the set standard (Myeda & Pitt, 2012). The differences in measurements are harnessed in coordinated feedback and integrated into appropriate review processes in order to develop suitable strategies for improved performance (Amaratunga & Baldry, 2002).

The activities in a typical performance management loop include identifying and use of an appropriate performance measurement tool and assessing the performance after a definite period of executing operational activities using the performance measurement tool. The outcome of performance assessment, known as feedback, should be analysed and evaluated so that suitable performance improvement strategies can be developed. The proposed improvement strategies are then implemented (Melnyk et al., 2014). The process is repeated several times until performance improvement is attained. Figure 1 shows the schematic diagram of the processes involved in performance management. Performance management is important to every FM unit as it helps the unit to develop, operate and maintain functional facilities suitable for the execution of the core function of the organization.

The exercises also assist the FM unit to know the level of customers' satisfaction with its services in order to identify area(s) of improvement.

In this regard, the objective of this research is to find answers to these two generic questions:

1. How do FM operatives assess their performance?
2. How do FM customers assess the performance of the FM unit?

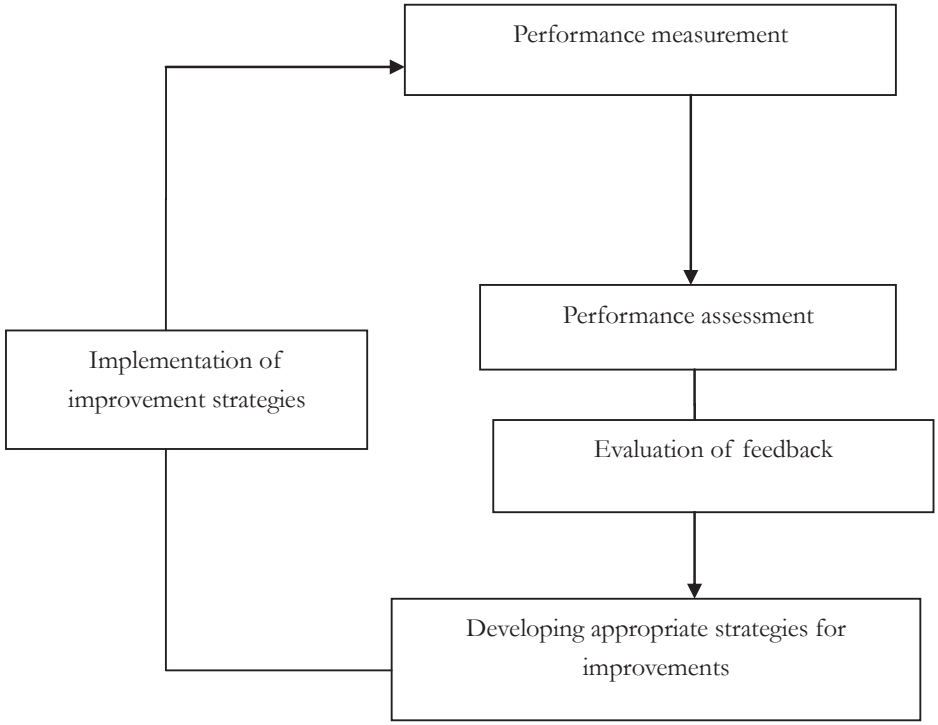

Figure 1: Schematic diagram of performance management (from typical FM operation)

The import of this research is to encourage FM operatives to embrace the concept of performance management by using a simple but effective performance measuring system. They should pay due diligence to the information harnessed from performance assessment by listening to the voice of the customers (Isa & Usmen, 2015). Performing detailed analysis on the feedback enables the FM operatives to identify area(s) requiring critical attention around which performance improvement strategies should be built for implementation. Continuous implementation of performance improvement strategies enables the FM operatives to develop functional facilities suitable for the performance of the core functions of the organisation, to allow for suitable workplace interface, and to promote improvement in customers' satisfaction, thereby adding to the value chain of the organisation and its competitive

advantages within the industry of the organisation (Porter & Miller, 1985; Kok et al., 2011; Simatupang et al., 2014).

This paper is an excerpt from a larger research effort. The institution, operational units and personnel will be referred to in generic terms. The structure of this paper begins with a literature review in order to establish the theoretical foundation for the subject of performance management. The third section discusses the research method which leverages on mixed methods for both data collection and analysis. The fourth section explores the research findings and discusses the findings in the light of appropriate literature, while section five provides conclusions gleaned from the research findings and thereafter makes recommendations for further research.

2. LITERATURE REVIEW

This section will provide a synthesis of literature focusing on facilities within the learning environment, performance measurement, performance assessment, and performance improvement as well as performance management in order to identify necessary gaps which this research seeks to address.

2.1 Customers' relationships in a learning environment

A typical higher education (HE) institution can be likened to "Organisations that seek to optimally allocate resources to maximize educational output" (Vidalakis et al., 2013: 489). These resources can be estates and facilities, human resources, curricula, and students. The learning environment is a major factor in effective teaching and learning, whether in the physical or virtual space. The facilities available in the learning environment contribute significantly to the success of the knowledge transfer efforts of HE institutions (Uline & Tschannen-Moran, 2008; Vidalakis et al., 2013). The design and development of school facilities should integrate "…the educators' and designers' thoughts to create an intelligent combination of design elements to promote learning" (Jarman et al., 2004: 38). Uline and Tschannen-Moran (2008) contrasted the desire for rigorous curricula and highly-qualified teachers with the physical environment where learning takes place as necessary factors for effective teaching and learning. The school climate or learning environment, in the opinion of these authors, encompasses the physical and social environment. The physical environment includes the building conditions, especially the features such as age, air temperature and quality, lighting and acoustical control. In the social environment, the hygiene, orderly arrangement of school facilities, teacher behaviour and attitudes, community engagement and the leadership style of school administrators influence the learning outcome (Uline & Tschannen-Moran, 2008). In addition, well maintained facilities have the potential of added value to HE institutions, "perhaps even greater than the construction of new high-profile facilities" (Vidalakis et al., 2013: 499). Odediran et al. (2015) observe that the quality

of the education that students receive bears direct relevance to the availability or lack of physical facilities and the overall atmosphere in which learning takes place. Facilities play pivotal roles in the actualisation of the educational objectives of HE institutions by satisfying the physical and emotional needs of both staff and students. Therefore the facilities should be 'user-friendly', focusing on user needs (Vidalakis et al., 2013).

The business interests of a typical HE institution revolve around teaching, learning and research. The academics execute these core functions within and outside the physical campuses of the respective institutions, in both the physical and virtual space (Jamieson et al., 2000; Jamieson, 2003). The contribution of FM is seen in the interface between functional facilities, facilities services and the work processes of the academics (Kok et al., 2011). Furthermore, "…management of higher educational establishments is focusing attention on facilities' improvement for a number of reasons, especially in a search for competitive advantage" (Amaratunga & Baldry, 2000: 295). Thus, the FM unit that provides the requisite support facilities for the performance of the core function of the organisation it serves "…often deals with identifying relationships the humans have with their environment" (Amaratunga & Baldry, 2002: 334) and thus should be pragmatic in the management of the built facilities in the workplace interface.

2.2 Performance measurement and the tools

There are a number of tools or models available for the measurement of the performance of the whole or part of the organisations' operations. A few of them will be mentioned here, such as total quality management (TQM), and the balanced scorecard (BSC) (Paranjape et al., 2006), the business excellence model (BEM), the Capability Maturity Model (CMM), the key performance indicators (KPI) (Meng & Minogue, 2011), the just-in-time (JIT) model (Bortolotti et al., 2013; Meybodi, 2015), and Six Sigma (Isa & Usmen, 2015). The objectives of each model are to improve on current performance in order to achieve the goals of the organisation (Amaratunga & Baldry, 2002). Each model has unique variables for measuring performance and standard units for the assessment of that performance. However, the following paragraphs will discuss briefly the Six Sigma (being advocated for use in service-related industries) and the JIT (the performance measurement system being used by the FM unit for this research) in order to explore their merits, demerits and ease of application.

Initially the Six Sigma and the JIT model were designed for use in the manufacturing industries; gradually they are being used in other service-related industries (Pheng et al., 2011; Isa & Usmen, 2015). The Six Sigma model is a customer-focused methodology that places emphasis on listening to the voice of the customer (VOC) in order to "…identify their needs and requirements, and converting them into specifications in the design of the product or services that can be

monitored and measured" (Isa & Usmen, 2015: 72). Isa and Usmen (2015) affirmed in their research that the Six Sigma method is best implemented by incorporating other tools. The authors used a variant of the Six Sigma (Lean Six Sigma) to measure the performance of FM in the development and execution of construction projects in an HE institution along with other tools such as the DMAIC (define, measure, analyse, improve and control) framework, Pareto analysis, voice of the customer (VOC), process mapping, cause and effect (CE) matrix, failure mode and effect analysis (FMEA) (Isa & Usmen, 2015). Furthermore, the Six Sigma tool is heavily dependent on numerical records and statistical analysis. This model is not commonly used as a model in FM operation largely because of the complex nature of data collection, heavy leaning on statistical analysis and the need to supplement the model with other tools.

On the other hand, the JIT is simple, making it easy to measure and assess performance with just two variables to measure for data collection. The core components of a typical JIT instrument are "…elimination of waste and respect for people" (Meybodi, 2015: 110) which make it suitable for use in an FM environment. In the FM scenario, the JIT is operated with two time components or variables, the T1 and T2 (Bortolotti et al., 2013). The T1 component represents the time between when a customer lodges a request with the FM unit and when the FM operative actually visits the customer to inspect the request, treat or report it for further actions. T2 is the time between inspection and when the request is eventually addressed. The FM operatives assess their performance first by focusing on T1 while the customer assesses the FM performance using the T2 threshold. Meybodi (2015) observed that improvement in customer satisfaction requires that the service provider should make deliberate efforts to reduce the length of down time for employees and the machine (T2) used for the performance of the core function of the organisation. In this regard, if the request of the customer is not addressed early, the service provider should maintain a polite and steady flow of relevant information with the customer(s), thus reducing the psychological stress of the T2 variable. However, commitment to progressive performance assessment (with accurate data for T1 and T2) and objective analysis of feedback enable FM operatives to improve on their service delivery within acceptable limits of the T1 and T2 thresholds for the different array of services (Bortolotti et al., 2013).

2.3 Performance assessment and analysis of result

The objectives of performance measurement will not be achieved without adequate and periodic assessments of actual performance. Performance assessment can be seen as the comparison of performance results against the expectations of the measuring system in operation (Myeda & Pitt, 2012). The assessments should be timely, accurate and relevant. The exercise should be undertaken in ways easily understood by the actors using the performance measuring system being evaluated

(Myeda & Pitt, 2012). The differences in measurements are harnessed in coordinated feedback; this in turn is used to develop suitable strategies for improved performance. The indicators (in PM) are designed to achieve the goals of the organisation while the feedback from periodic observations (assessments) is used to improve the production or work process.

Performance measurement or its tools are not ends in themselves but road maps for more effective management (Amaratunga & Baldry, 2002). Although several performance measurements have been conducted, or their tools utilized, they are not often followed by effective analysis of results or honest attempts at improved performance (Amaratunga & Baldry, 2002). The performance assessment records obtained from the feedback information should be subjected to further investigation. Effective analysis of feedback facilitates the identification of the magnitude and source of variance. Feedback can be obtained using the instrument of an individual or group interview, a response to a questionnaire, a focus group session or through the Delphi technique (Khalil et al., 2014). The analysis of the inputs from relevant stakeholders during the feedback exercise should be followed by focus group session(s) (Breen, 2006).

2.4. Performance management

Performance measurement and performance management follow one another in an iterative process; management follows measurement (Folan & Browne, 2005). The contribution of Amaratunga and Baldry (2002a) is very informative, noting that performance management is the use of performance measurement information to effect positive change in organisational culture, systems and processes by helping to set agreed-upon performance goals, and allocating and prioritising resources. It challenges managers to either confirm or change current policy or ways of doing things to meet the goals of the organisation. Performance management allows the FM unit to progressively refine and improve its operations by harnessing the information (feedback) from the assessment exercises carried out periodically to test the effectiveness of the measurement system in place. Successful performance management requires the integration of performance measurement and the feedback from assessment into planning for improvements in existing performance output. In this regard, a performance management system translates FM operation from a reactive to a proactive standpoint, helping to develop the required synergy for effective partnership with the actors executing the core functions of the HE institution.

In order to move from performance measurement to performance management, Amaratunga and Baldry (2002a) suggested four action steps which are summarised as follows:

1. After analysis of performance measurement, develop broad areas of performance targeted for improvement.

2. Continuously test the performance improvement strategies to confirm whether they are working, and if not, why not.
3. Establish the right structure which facilitates the effective use of performance measurement results.
4. Use the performance measurement results to bring about change in the organisation.

Performance management provides intelligent information for decision makers at all levels to assess the achievement of predetermined goals (Amaratunga & Baldry, 2002a). It enables facilities managers to track past progress in order to learn about the future; it provides a feedback loop that supports decisions at all levels of the FM organisation (Amaratunga & Baldry, 2002a; Buys & Nkado, 2006). Performance management challenges FM operatives to practise the art of continuous data collection, and analysis and interpretation of feedback information to facilitate the development of appropriate improvement strategies. It also encourages the use of performance management data to support oversight and compliance activities (Amaratunga & Baldry, 2002; Lindhard & Larsen, 2016). Effective performance management supports proposals for changes or requests for additional resources as it illuminates the link between strategies, measures and expected outcomes (Buys & Nkado, 2006). To ensure consistent alignment of the operation of FM in order to achieve the business interest of any organisation, it is important to embrace and practise the continuous exercise of performance measurement, assessment and management, which leads to performance improvement.

Research efforts abound and are continuous in these areas of performance measurement, assessment and management, but very limited efforts have been dedicated to the coordinated use of these discrete phenomena to implement performance improvement in one exercise. The focus of this research is to demonstrate how the progressive performance of the activities in the performance management loop can facilitate performance improvement and guarantee customer satisfaction.

3. RESEARCH METHOD

The subject of performance measurement and performance assessment studied along with performance improvement and performance management in one research exercise cannot be successful using any mono-research method. Therefore, a mixed method is ideal, because the mixed-methods research uses the quantitative and qualitative systems for both data collection and analysis within a single study (Johnson & Onwuegbuzie, 2004; Yin, 2014). Using the combined method has the potential for providing a better understanding of the research problems than using any of the mono-methods independently (Molina-Azorin, 2012). This method of

research is increasingly being used in different fields of study, including project management, engineering and the built environment studies (Bosch-Rekveldt, 2015; Cameron & Sankaran, 2015; Thomas & George, 2015). The focus of this research can be divided into two broad components, namely management of the relationship between customer and service provider, and performance assessment. The outcome of both phases of the research will facilitate the development of performance improvement strategies, while the continuous repetition of the exercise ensures actual performance improvements. Unearthing the latent issues affecting a smooth relationship between service providers and their customers requires the use of research instruments that will allow the respondents to volunteer information freely and in great detail. In this regard, the qualitative research method is useful. Similarly, performance assessments are usually associated with numerical figures; this aspect of the research is best accomplished through quantitative methods. Integrating both methods enhances the quality of information available for analysis and decision making. Furthermore, the Delphi technique was used to gather anonymous information; this allows respondents within the same organisation to provide independent information on the subject under reference without coercion (Ogbeifun et al., 2017).

The target population for this study were the nine deans of faculties at the strategic level of leadership, all head of departments (HODs) at the tactical level, the four directors at the strategic level of leadership in the FM unit, and nine managers at the tactical level. The participants were selected purposively to apply their knowledge to address the research questions (Hasson et al., 2000; Day & Bobeva, 2005). They were all communicated with and invited to participate in the research; seven deans, twenty HODs, four directors and eight managers participated in the research.

Although there are no strict rules on the sample size in qualitative research, the principle is to attain 'saturation' of information (Hennink et al., 2011). Nevertheless, some proposals suggest "…6-8 subject to homogeneous samples and 12-20 for maximum variation" (Zyzanski et al., 1992: 233). The goal is not achieved in the quantity of sample but in the quantity and diversity of information that effectively addresses the research questions (Hennink et al., 2011), thus ensuring efficient and effective saturation of categories "…with optimal quality data and minimum dross" (Morse et al., 2002: 18). The population and sample for this research were limited to the leaders at the strategic and tactical levels of leadership among both the academics and FM operatives because they are the key decision makers in matters affecting the development, operation and management of budget for facilities operations. Other customers (academic staff and students) have limited contact with facilities needs; usually only when there is a fault. If they require a new installation, change of use, or expansion, they will naturally go through the HODs to the deans before going to the FM unit. Table 1 shows the target population and the sample which actually

participated in the research. Although the number of participants comprise just fifty per cent (50%) of the targeted population, having 27 academics and 12 participants from the FM unit was a good mix and still satisfies the requirement for qualitative research.

The single interview guide used for data collection had both qualitative and quantitative components for ease of data collection. The interview guide was divided into four parts. The first part required generic but coded information about the respondents. It was generic in the sense that each respondent was expected to be anonymous and coded in order to differentiate the response from strategic and tactical leaders among both the academics and FM operatives. The second part required information on the level of relationship between the customers and the FM operatives. The third part was dedicated to performance assessment. Here, the customers rated their level of satisfaction on the service delivery of FM operatives in areas such as capital development, academic environment, operation and maintenance, occupational health and safety, and computerised maintenance management systems, and the FM unit rated their level of performance on service delivery to customers. The final section requested suggestions on how to improve on service delivery and customer satisfaction, as well as requesting the respondents to participate in the second phase of the research which was targeted towards the development of key performance indicators (KPIs). The research data was collected between April and October, 2014. The analysis of the qualitative responses was accomplished by adopting the principles of content analysis. The information from the customers (academics) was compared with the responses from the FM operatives in order to be able to make an informed judgement. The periodic reports from the FM unit were evaluated in terms of technical content, clarity, performance assessment and as tools for effective communication with customers.

Table 1: Classification of participants

Classification	Response			
	Target	Silent	Decline	Participated
Academic strategic-deans	9	2	-	7
Academic tactical-HODs	57	25	12	20
FM strategic	4	-	-	4
FM tactical	8	-	-	8
Total	**78**	**27**	**12**	**39**

The quantitative component of the interview guide provided information on the performance assessment by FM operatives and the academics. Owing to the limited number of participants, the simple arithmetic mean was used to evaluate the responses instead of the laborious statistical approach. Their responses were complementary to the information gleaned from the qualitative section of the

exercise. The graphical representation of the information after the analysis of the feedback from the assessment is discussed in detail in the findings and discussion section. The feedback from the performance assessment was subjected to further analysis in order to identify the magnitude and sources of variances (Figure 3). The variances observed were discussed in focus group sessions organized for the division responsible for maintenance operation in the FM unit. Thereafter performance improvement strategies were developed as shown in Table 2.

4. FINDINGS AND DISCUSSIONS

The findings are discussed simultaneously in the following sections. Section 4.1 provides the background information on the FM unit and its operation, section 4.2 discusses the FM operations and the level of customers' satisfaction, while section 4.3 provides information on the focus group session and how it was used to develop performance improvement strategies.

4.1 Background information

The facilities management (FM) unit in this institution is known as the Operations Department (OD). However, the generic term 'FM' will be used in this paper instead of 'OD' to refer to the same organisation. FM in this institution, like every FM unit in other HE institutions, is responsible for the development, operation and maintenance of the built facilities, technology and services for a suitable academic environment which enhances the performance of the core functions of teaching, learning and research. An excerpt from the vision and mission statement of this FM unit indicates that it aspires "…to be a high-performing, reliable, and dependable division that manages the development, maintenance and protection of infrastructure, buildings, installations and garden in promoting the institution as a preferred academic institution to student and staff" (OD Annual Report, 2012: 1). This glowing mission statement notwithstanding, the academics are not enthusiastic about the performance of the FM unit, and this has created gaps in their relationship. An example of the area of discontent is the quality of the periodic report. Although the FM unit provides a periodic report on its operation (especially maintenance), the academics complain that the reports are too generic, economical in detail and not customer friendly. They observed that "…in the present structure of the report, no head of department can relate the report to the situation in their department in terms of the quantity of their requests addressed or otherwise or the functional state of the facilities in their portfolio". Thus the periodic reports were not serving their purpose of educating the customers and were not an effective tool for communication.

The FM operatives opined that they are making concerted efforts to "bridge the gaps in perceived areas of discontent". One of their efforts is the creation of the Campus Operations Forum (COF), where the academics and FM operatives meet

periodically to discuss facilities-related issues. As laudable as this venture is, one of the FM Directors observed that "…less than 10% of the academics – HODs – attend the quarterly COF". The majority of the academics, on their part, complain that "they do not know when such meetings are scheduled"; a few acknowledge that they sometimes get the information about the meetings but regret that they could not attend "because it clashes with other engagements". However, the academics who actively participate in the COF confirm:

> COF is a forum where the FM unit provides feedback on issues raised in previous meetings or requests sent to them from different units of the campus, explanations provided for services rendered, pending items and new issues identified for action. Each report reflects FM's action subject to budgetary constraints.

In order to reduce the widening gap in their relationship, improve on the level of service delivery of the FM operatives and achieve a higher level of customer satisfaction, an interview was used to collect relevant information from the customers and the service provider (FM operatives). The assessment was two-fold in order to answer the research question on FM's self-assessment and FM customers' assessment. The analyses of the feedback encompass capital development, academic environment, operation and maintenance, occupational health and safety, and a computerised maintenance management system, but for brevity, the information on operation and maintenance will be used to illustrate the process.

4.2 Operation and maintenance

The execution of the day-to-day activities necessary for the achievement of the goals set for teaching, learning and research allows the academics to use the built facilities, fixtures, features and services continuously. The quality and functional state of these facilities influence the comfort, composure and productivity of the academics (Vidalakis et al., 2013; Odediran et al., 2015). The FM unit's commitments to the ideals of operating functional facilities can be summarised in these statements, gleaned from the FM annual report of 2013:

> To maintain all academic and support facilities and infrastructure in order for them to be readily available, accessible, functional and safe, in support of teaching, learning, student life and research. To provide an enabling environment in which academics can excel on a sustained basis through: maintenance of existing facilities; upgrading and expansion of facilities.

In order to fulfil these objectives, the FM unit practises the combination of a "planned, scheduled and breakdown maintenance" system (Hinks & McNay, 1999; Lavy, 2008). However, the majority of the interactions of the academics with FM operatives centre on breakdown or demand maintenance as well as space modifications or change of use (Amaratunga & Baldry, 2000; Hayes, 2006).

Generally, performance assessment brings to fore how the customer views the performance of the service provider (FM unit) and allows the service providers (FM unit) to see how effective and satisfactory their performances are to their customers (Myeda & Pitt, 2012). In the seven items measured, gleaned from literature and a pilot study for this research (Hinks & McNay, 1999; Lavy, 2008; Bortolotti et al., 2013; Meybodi, 2015), the FM operatives rated their performance above average in almost all of them but the academics rated FM above average in four of the items and below average in the other three. The items rated below average are more critical to the operations of the academics, namely 'response time and down time' (Bortolotti et al., 2013; Meybodi, 2015). Another component of this assessment is the contribution of the academics that are very active in the COF, their assessments being more encouraging, but these academics are in the minority. Figure 2 provides the graphical representation of the feedback from the customers and the FM operatives.

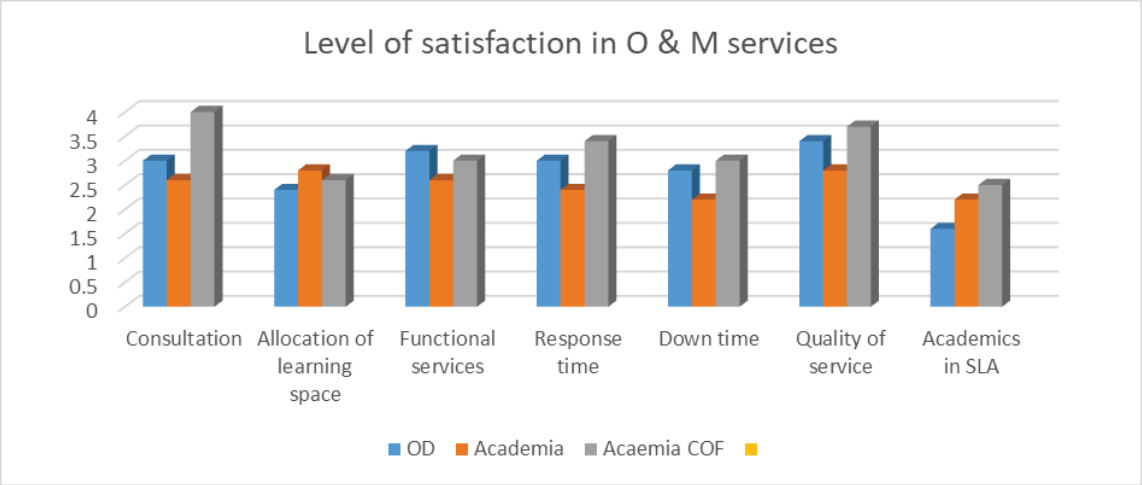

Figure 2: Level of satisfaction regarding operation and maintenance services (Ogbeifun, 2016: 121)

In the interviews with FM operatives and the academics, the response time for the T1 threshold set by this FM unit is indicated as 48 hours; that is, upon receipt of a request, its operative will visit the customer and, if possible, address the request within 48 hours. The majority of the academics observed that FM operatives may visit to inspect the request within their stipulated 48 hours, but the requests are not usually addressed immediately, or only after a long delay and sometimes after repeated requests, thus resulting in prolonged down time (T2) (Bortolotti et al., 2013; Meybodi, 2015).

The performance assessment result was subjected to further discussions and analysis with both the academics and FM operatives (Amaratunga & Baldry, 2002;

Myeda & Pitt, 2012). It was discovered that allocation of learning space was not entirely the responsibility of the FM unit; they are just members of the committee, as are the academics. In the same sense, developing a service level agreement (SLA) for service providers with the active participation of the academics was not seen as a critical issue as long as the service was rendered effectively and ensured progressive consultations. The main concerns of the academics were in the area of functional facilities and services, response and down time as well as the quality of services (Bortolotti et al., 2013; Meybodi, 2015; Ling & Wong, 2016; Atkin & Bildsten, 2017). This led to the use of another set of questionnaires by adopting the Delphi technique which helped to amplify the areas of variance. The Delphi technique is a tool used for the collection of vital information from a team of experts (Day & Bobeva, 2005; Hallowell & Gambatese, 2010) who anonymously respond to the research question and no participants can be traced to their contributions (Franklin & Hart, 2007). This system allows for objective responses without coercion or complicity (Ogbeifun et al., 2017). The analysis of the anonymous responses from both the academics and FM operatives showed that FM operatives were deficient in all the items measured (Figure 3) and required a focus group session to discuss the details in order to unearth the latent causes of these variances.

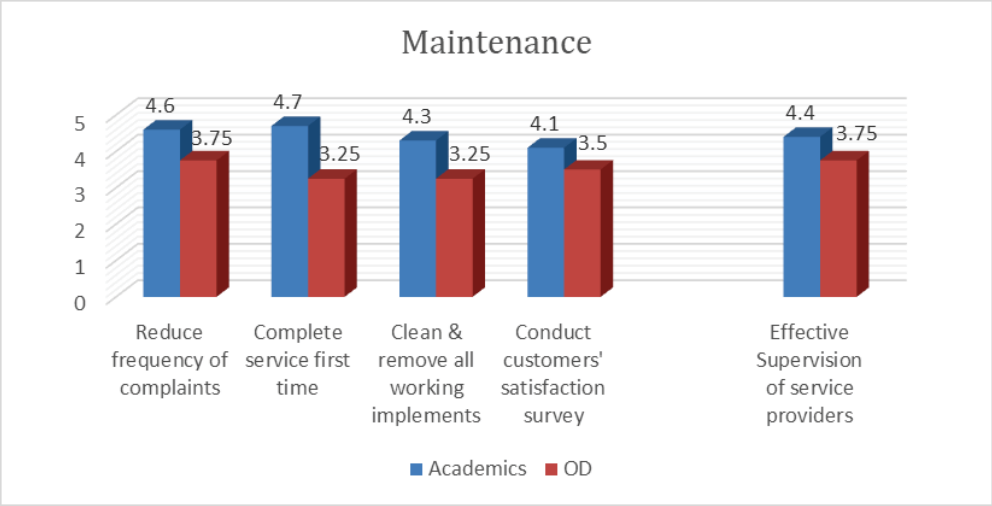

Figure 3: Areas of variance in maintenance operations (Ogbeifun, 2016: 137)

4.3 The focus group session

The focus group (FG) session was made up of the leaders at the strategic and tactical levels of leadership in the FM unit; they include two campus directors and five maintenance managers. During the FG session, it was discovered that the variances observed were not necessarily due to lack of technical competence or inadequate resource of human capacity but largely to the low level of understanding of the effects of the non-functioning facility on the performance of academic services.

Furthermore, it revealed that the majority of FM operatives lack the soft skill of interpersonal relationships and effective communication with customers.

As shown in Figure 3, in order to reduce the frequency of complaints, it was suggested during the FG session that FM operatives should improve on the T1 and T2 component of the JIT threshold. The FG session identified with the assessment and challenged FM operatives to aim at completing service first time, clean and remove all working implements after each work operation, improve on effective supervision of both in-house and service providers and conduct periodic customer satisfaction surveys. In this way, the FM unit will improve on their performance on the T2 time threshold and service delivery (Bortolotti et al., 2013; Meybodi, 2015). Effective management of these items would result in the reduction of the length of down time, reduce the frequency of complaints from the academics and increase the level of customer satisfaction.

Table 2: Performance improvement strategies

S/No	Identified variance	Suggested performance improvement strategies
1	Response time	1. Ensure visit with customer within stipulated 48 hrs (T1) 2.Technicians should visit customers equipped with basic tools and materials to address minor complaints immediately 3. Equip technicians with communication tools so that they can communicate with superior officer for timely decision.
2	Reduce down time, complete service first time	1. After assessment of customer's request, move to site with all required materials. 2. Keep adequate stock of basic repair materials. 3. Continuously train artisans and technicians in order to improve on their proficiency. 4. Allocate work request to external service providers according to their trade specialisation. 5. Give authority to campus directors to authorise expenditure on purchase of materials or commission external service providers within a specified financial threshold.
3	Improve on quality of service, clean workplace after each operation	1. Provide effective supervision for all work process being executed by both in-house and external service providers. 2. Equip all supervisors with adequate communication and logistic tools, so that they can keep track of artisans and technicians. 3. Supervisor and other senior FM operatives should visit with the academics in order to establish cordial relationship with customers. 4. Conduct periodic customer satisfaction surveys.

The FG session used the information from the two assessments to suggest performance improvement strategies, as shown in Table 2. It was agreed at the FG session that the exercise should be repeated after six months in order to determine the improvements made on the T2 threshold, which eventually will translate to improved levels of service delivery, customer satisfaction and relationships between FM operatives and the academics. This will facilitate the provision of functional facilities for the performance of the core activities of teaching, learning and research.

5. CONCLUSION

As shown in Figure 1 and demonstrated in this research, effective performance management requires dedicated commitment to the respective activity in the performance management loop. Although the FM operatives rated their performance as above average in the performance assessment exercices, the acid test was how the customer (academics) expressed their level of satisfaction, which were not complimentary, especially in terms of the response time for addressing their request, the management of down time, and the functional quality of the facilities in their portfolio. Furthermore, the analysis of feedback amplified the areas of variance contributed largely by FM operatives. The FG session allowed the FM operatives to identify the latent reasons for their low performance and discuss the observed variances before the development of appropriate performance improvement strategies (Table 2).

This research has shown that peformance improvement can be achieved through deliberate commitment and periodic repetition of the key activities in the performance management loop. Notably, performance assessment allows FM operatives to listen to the voice of the customers, which is essential for performance improvement. Therefore FM operatives should adopt the soft skill of interpersonal relationships and effective communication so that they can build the required synergy with the academics in the development, operation and maintenance of functional facilities suitable for the execution of the core fuctions of teaching, learning and research. Deliberate efforts should be made, at micro and mega fora, to communicate research findings to FM professionals (similar to the FG session in this research). This will facilitate performance improvement in FM, allowing the unit to contribute meaningfully to the value chain of the organisation and its competitive advantages within the industry of the organisation. Specifically in HE institutions, FM will be able to provide and maintain facilities suitable for an academic environment for internal customers and visitors as well as project the image of the institution in the proximate communities.

Since this research was conducted on a single site, further research efforts should conducted involving more HE institutions in order to enable generalisation of

conclusions.

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6. REFERENCES

Amaratunga, D. & Baldry, D. (2000). Assessment of facilities management performance in higher education properties, *Facilities,* 18(7/8): 293-301.

Amaratunga, D. & Baldry, D. (2002). Performance measurement in facilities management and its relationships with management theory and motivation, *Facilities*, 20(10): 327-336.

Amaratunga, D. & Baldry, D. (2002a). Moving from performance measurement to performance management. *Facilities,* 20(5/6): 217-223.

Atkin, B. & Bildsten, L. (2017). A future for facility management. *Construction Innovation*, 17(2): 116-124.

Bortolotti, T., Danese, P. and Romano, P. (2013). Assessing the impact of just-in-time on operational performance at varying degrees of repetitiveness.*International Journal of Production Research*, 51(4): 1117-1130.

Bosch-Rekveldt, M. (2015). Applying mixed methods for researching project management in engineering projects, In: Pasian, B. (Ed.) *Designs, methods, and practices for research of project management*. Aldershot, UK: Gower Publishing, pp. 327-340.

Breen, R. L. (2006). A practical guide to focus-group research. *Journal of Geography in Higher Education,* 30(3): 463-475.

Buys, F. & Nkado, R. (2006). A survey of maintenance management systems in South Africa tertiary educational institutions. *Construction Management and Economics*, 24: 997-1005.

Cameron, R. & Sankaran, S. (2015). Mixed methods research in project management. In: Pasian, B. (Ed.) *Designs, methods, and practices for research of project management*. Aldershot, UK: Gower Publishing, pp. 273-286.

Day, J. & Bobeva, M. (2005). A generic toolkit for the successful management of Delphi studies. *The Electronic Journal of Business Research Methodology*, 3: 103-116.

Douglas, U. M. (2016). Finding the niche towards performance excellence: A study of facilities management firms in Malaysia. *Journal of Facilities Management*, 14(4): 330-34.

Dziadosz, A. & Meszek, W. (2015). Selected aspects of determining of building facility deterioration for real estate valuation. *Procedia Engineering*, 122: 266-273.

Folan, P. & Browne, J. (2005). A review of performance measurement: Towards performance management. *Computers in Industry*, 56: 663-680.

Franklin, K. K. & Hart, K. J. (2007). Idea generation and exploration: Benefits and limitations of the policy Delphi research method. *Innovative Higher Education,* 31: 237-246.

Fraser, K. (2014). Facilities management: The strategic selection of a maintenance system. *Journal of Facilities Management*, 12(1): 18-37.

Hallowell, M.R. & Gambatese, J.A. (2010). Qualitative research: Application of the Delphi method to CEM research. *Journal of Construction Engineering and Management*, 136(1): 1-9.

Hayes, F.X. (2006). A proactive solution. *American School and University*, pp. 310-312.

Hasson, F., Keeney, S. & McKenna, H. (2000). Research guidelines for the Delphi survey. *Journal of Advance Nursing*, 32: 1008-1015.

Hennink, M., Hutter, I. & Bailey, A. (2011). *Qualitative research methods*. London: Sage Publications.

Hinks, J. & McNay, P. (1999). The creation of a management-by-variance tool for facilities management performance assessment. *Facilities,*17(1/2): 31-53.

Isa, M. F. M. & Usmen, M. (2015). Improving university facilities services using Lean Six Sigma: A case study. *Journal of Facilities Management*, 13(1): 70-81.

Jafari, L. & Makisn, V. (2015). Joint optimal lot sizing and preventive maintenance policy for a production facility subject to condition monitoring. *International Journal of Production Economics*, 169: 156-168.

Jamieson, P., Taylor, P.G., Fisher, K., Trevitt, A.C.F. & Gilding, T. (2000). Place and space in the design of new learning environment. *Higher Education Research & Development*, 19(2): 221-236.

Jamieson, P. (2003). Designing more effective on-campus teaching and learning spaces: A role for academic developers. *International Journal for Academic Development,* 8(½): 119-133.

Jarman, D., Webb, L. & Chan, T. C. (2004). A beautiful school is a caring school. *School Business Affairs*, June 2004: 37-38. Available online at: www.sba_june_04_beautiful_school.pdf [Accessed 4 September 2015].

Johnson, R.B. & Onwuegbuzie, A.J. (2004). Mixed methods research: A research paradigm whose time has come. *Educational Researcher*, 33(7): 14-26.

Kennedy, M. (2008). Ready to renovate. *American School and University*, July: 14-18.

Khalil, N., Kamaruzzaman, S. N., Baharum, M. R., Husin, H. N. & Nawawi, A. H. (2014). Significance of attaining users' feedback in building performance assessment. In: *Proceedings of the MATEC Web Conference, 15 01004*, Available online at: http://dx.doi.org/10.1051/matecconf/20141501004, [Accessed 21 July 2017].

Kok, H. B., Mobach, M. P. & Omta, O.S.W.P. (2011). The added value of facility management in the educational environment. *Journal of Facilities Management*, 9(4): 249-265.

Lavy, S. (2008). Facility management practices in higher education buildings. *Journal of Facilities Management*, 6(4): 303-315.

Lavy, S., Garcia, J. A., Scinto, P. & Dixit, M. K. (2014). Key performance indicators for facility performance assessment: Simulation of core indicators. *Construction Management and Economics*, 32(12):1183-1204.

Lindhard, S. & Larsen, J. K. (2016). Identifying the key process factors affecting project performance. *Engineering, Construction and Architectural Management*, 23(5): 657-673.

Ling, F. Y. Y. & Wong, D. M. G. (2016). Redesigning facility management operatives' jobs to increase work outcomes. *Journal of Facilities Management*, 14(1):50-68.

Melnyk, S. A., Bititci, U., Platts, K., Tobias, J. & Andersen, B. (2014). Is performance measurement and management fit for the future? *Management Accounting Research,* 25(2): 173-186.

Meng, X. & Minogue, M. (2011). Performance measurement models in facility management: A comparative study. *Facilities*, 29(11/12): 472-484.

Meybodi, M. (2015). The links between just-in-time practices and alignment of benchmarking performance measures. *The TQM Journal*, 27(1): 108-121.

Molina-Azorin, J.F. (2012). Mixed methods research in strategic management: Impact and application. *Organizational Research Methods*, 15(1): 33-56.

Morse, J.M., Barrett, M., Mayan, M., Olson, K. & Spiers, J. (2002). Verification strategies for establishing reliability and validity in qualitative research. *International Journal of Qualitative Methods,* 1(2): 13-22.

Myeda, N. E. & Pitt, M. (2012). Understanding the performance measurement system (PMS) for facilities management (FM) industry in Malaysia. In: *Proceedings of the PMA Conference,* Cambridge, UK, 11-12 July.

Odediran, S. J., Gbadegesin, J. T. & Babalola, M. O. (2015). Facilities management practices in the Nigerian public universities. *Journal of Facilities Management*, 13(1): 5-26.

Ogbeifun, E. (2016). *Evaluating and and aligning facilities management operations in a South African higher education institution: A case study*. Unpublished PhD thesis. Available online at: https://scholar.google.co.za/scholar?hl=en&as_sdt=0%2C5&q=Evaluating+and+aligning+facilities+management+operations+in+a+South+African+higher+education+institution%3A+A+case+study&btnG= [Accessed 15 April 2018].

Ogbeifun, E., Mbohwa, C. & Pretorius, J. H C. (2017). Achieving consensus devoid of complicity: Adopting the Delphi technique. *International Journal of Productivity and Performance Management*, 66(6): 1-16.

Paranjape, B., Rossiter, M. & Pantano, V. (2006). Insight from the balance scorecard performance measurement systems: Successes, failures and future - a review. *Measuring Business Excellence,* 10(3): 4-14.

Pheng, L. S., Arain, F. M. & Fang, J. W. Y. (2011). Applying just-in-time principles in the delivery and management of airport terminal building. *Built Environment Project and Asset Management*, 1(1): 104-121.

Porter, M.E. & Millar, V.E. (1985). How information gives you competitive advantage. *Harvard Business Review*, July – August: 149-152.

Simatupang, T.M., Piboonrungroj, P. & Williams, S.J. (2014). The emergence of value chain thinking. In: *Proceedings of T-LOG 2014*. Available online at: http://s3.amazonaws.com/academia.edu.documents/34563986/66.pgf?AWSAccessKeyId=AKIAJ56TQJRTWSMTNPEA&Expires=1469032947&Signature=Mh3eQaqStDrID47%2FDGFYC7dGDDI%3D&response-content-disposition-inline%3B%20filename%3DThe Emergence of Value Chain Thinking.pdf [Accessed 30 June 2016].

Thomas, J. & George, S. (2015). The value of mixed methods. In: Pasian, B. (Ed.) *Designs, methods, and practices for research of project management*. Aldershot, UK: Gower Publishing, pp. 287-300.

Uline, C. & Tschannen-Moran, M. (2008). The walls speak: The interplay of quality facilities, school climate and student achievement. *Journal of Educational Administration*, 46(1): 56-73.

University of Johannesburg. Operations Department. (2012). *Central Technical Services, Annual Report* (Unpublished).

University of Johannesburg. Operations Department. (2013). *Central Technical Services, Annual Report* (Unpublished).

Vidalakis, C., Sun, M. & Papa, A. (2013). The quality and value of higher education facilities: A comparative study: *Facilities*, 31(11/12): 489-5004.

Yin, R.K. (2014). *Case study research - Design and methods* (5th Eed.). Singapore: Sage Publishing.

Zyzanski, S.J., McWhinney, I.R., Blake, Jr. R., Crebtree, B.F. & Miller, W. (1992). Qualitative research: Perspective on the future. In: Crabtree, B.F. & Miller, W.L. (Eds.). *Doing qualitative research*. London: Sage Publications.

A QUANTITATIVE STUDY ON THE MAGNITUDE OF CONSTRUCTION CLAIMS IN CONSTRUCTION PROJECTS IN NIGERIA

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ABSTRACT

The administration of construction projects in Nigeria is plagued by excessive claims which attract additional costs, and as well as leading to an adversarial relationship among project stakeholders. The purpose of this research is to assess construction claims' relationship with the original contract sum of construction projects in Nigeria. A quantitative approach in which archival data from 53 completed projects involving claims was used. Numerical data collected were analyzed using percentile ranking and Pearson's correlation. The study revealed that differing site conditions is the most frequent type of claim in construction projects in Nigeria. However, delay claims are uncommon because none of the projects experienced delay claims. The results also showed that contract ambiguity caused the highest number of claims with an average of 22% of the original contract sum while the overall claims averaged 60% of the original contract sum. This study will aid the understanding of the sources and the influence of claims on construction projects. This understanding will inform decisions on the deployment of strategies, approaches, and tools for inspiring construction project management.

Keywords: Claims, Contract, Construction, Correlation, Nigeria

1. INTRODUCTION

The construction industry is subject to inevitable changes because of the nature and complexity of operations and activities involved in the process of realising its final products. He et al. (2015) argued that construction projects are complex because they involve many human and non-human factors, usually have a long duration, involve various uncertainties and are characterized by complex relationships among participants. Therefore, the need to make changes during a construction project is a matter of practical reality. Commentators conclude that changes plague the construction projects, resulting in a wide range of claims the final effect of which is cost and time overruns (Singh & Kandan, 2005). A claim in the context of a construction project can be described as a legitimate request by a contractor for additional compensation on account of change in contract terms (Khekale & Futane, 2015). The request may be for additional time or cost, to enable the contractor to

successfully complete the works in project. Leegard (2011) described a construction claim as an unresolved change which includes a demand for money, time or some other adjustment in contract terms. Oke and Makinde (2011) observed that the main purpose of a claim is to cover the cost of the occurrence of unforeseen circumstances which result from default by the employer, or circumstances beyond the control of both parties. Yates and Esptein (2006) argued that construction claims result from an enormous range of factors such as improper drafting of contract documents, inaccurate preparation of bids, failure of the clients in their responsibility to provide access to the site, inability to take required action in a timely manner, or inadequate contract administration on the part of stakeholders. Kahssay (2003) in a survey in Ethiopia concluded that construction claims occurred when the terms and conditions of the contract change in such a way that the contractor is unable to recover expenses or profit. Chovichien and Tochaiwat (2006) in a survey in Thailand observed that construction claims occur in nearly every construction project. It should be noted that a construction claim is not a one-way affair because the employer and contractor have the right to claim against each other.

In Nigeria, the institution of the Budget Monitoring and Price Intelligence Unit (BMPIU) set up by the Federal Government in 2002 (now renamed the Bureau of Public Procurement, BPP) has not solved these problems. Ezekwesili (2005) observed that the problems faced by the BPP include ignorance and lack of cooperation among some officials to comply with the provisions of the circulars, inadequate definition of projects' scope, lack of involvement of professionals in some projects' packaging and supervision, inadequate documentation, and delays in responding to issues. As long as projects continue to exceed their budget, other projects will be dropped from the programme or the scope will be reduced to provide the funds necessary to cover the claims arising from cost growth. Such actions exacerbate the deterioration of a nation's infrastructure development. Therefore it is important to study the current trend and nature of construction claims in Nigeria.

Previous studies on construction claims in Nigeria have considered either a single claim head or treat claims holistically: none has considered different claim heads and used archival data to determine the magnitude of each claim head. In the Nigerian context, a considerable number of studies have been conducted by scholars to explain construction claims' management. Prominent among these are those of Omoregie and Radford (2006) who studied the causes and effects of infrastructure delays and cost escalation in Nigeria. Also, Akpan and Igwe (2001) investigated the methodology for determining price variations in project execution in Nigeria. Alabi and Razak (2013) worked on the case studies of claims arising from building collapses in Malaysia, Nigeria, Singapore and Thailand. Aibinu and Odeyinka (2006) worked on construction delays and their causative factors in Nigeria. Aibinu and Jagboro (2002) studied the effects of construction delays on project delivery in the Nigerian construction industry. Other relevant studies on construction claims include those of Oke and Makinde (2011) who researched modelling the magnitude of contract claims on selected building construction projects in Abuja, Nigeria. Kehinde

and Aiyetan (2002) also worked on the nature of contractual claims in building contracts in Nigeria. Oladapo (2007) studied a quantitative assessment of the cost and time impact of variation orders on construction projects in Nigeria. It is in this context that this study evaluated the frequency and magnitude of different types of construction claims in the study area. The relationship between different types of construction claims and the initial contract sum was also assessed. In line with the specific objectives of the study as stated above, a null hypothesis was postulated. This aided the conclusion on the statistical relationship between the magnitude of various types of construction claims and the original contract sum. The hypothesis for this research is that there is no significant relationship between the magnitude of various types of construction claims and the original contract sum.

2. LITERATURE REVIEW

There is no gainsaying that the twin problem of cost and time overruns may not yet be over as they still characterize construction projects in most parts of the world, especially in developing countries (Chigara et al., 2013; Ogunsemi, 2002). Mohamed et al. (2011) concluded that construction claims occur owing to the opportunistic bidding behaviour of contractors. This implies that contractors can bid low if there is an opportunity to recoup their losses through claims during the execution of the contract. Oyewobi et al. (2011) stated that the Nigerian construction industry is extremely susceptible to ethical erosion due to the heterogeneous nature of the industry which makes it imperative for construction professionals to exhibit a high level of professional ethics. In addition, one of the circumstances that deter meaningful development in the Nigerian construction industry is the menace of corruption and corrupt practices which in turn result in time and cost overruns. Obiegbu (2005) identified unethical practices in construction projects to include favouritism in the selection of contractors and the awarding of contracts to incompetent contractors in Nigeria through corrupt and informal relationships instead of merit.

Ho and Liu (2004) examined the dynamic nature of construction claims and opportunistic bidding and confirmed that construction claims are considered by many participants to be one of the most disruptive and unpleasant events of a construction project. Zaneldin (2006) found that claims are common in construction projects and can happen as a result of several factors that contribute to project delay or increased project cost, or both. Ren et al. (2003) confirmed that analysing various types of claims is an important task in resolving the claims. Therefore, it is important to critically review previous studies on the types and magnitude of construction claims in order to identify the gap in literature and determine the focus of this study. There have been several research studies in the area of the types and magnitudes of construction claims. There are two schools of thought on the classification of

construction claims. The first group of researchers categorized construction claims according to the conditions of contract, while the second group classified construction claims on a legal basis.

The first groups include an empirical study by Oladapo (2007) on the quantitative assessment of the time and cost impact of variation orders (as a particular type of claim) on construction projects in Nigeria. The results of the study indicated that variation accounted for about 79% and 68% of the cost and time overruns respectively. Moura and Teixeira (2007) examined the types of construction claims in Portuguese construction projects and identified eight types of construction claims. The results revealed that direct changes by the owner are the most expensive type of claim. In a survey in the United Arab Emirates (UAE) Zaneldin (2006) collected information for 124 claims related to different projects and classified them into six types of construction claims. The results of the study indicate that 'change claims' were the most frequent type of claim, based on the perception of the stakeholders. Fonseka (2008) also gathered opinions of the stakeholders on construction claims covering the causes, types, frequency and ways of minimising the claims in the UAE. The results identified six types of construction claims and concluded that the most common type of claim is extra works or changes. Similarly, Asiedu and Alfen (2014) found that variations and additional works resulting from changes in site conditions are the sources of claims that contribute to cost overrun in Ghana.

The second groups of researchers are those who categorize construction claims by considering the legal basis. In a study in India, Apte and Pathak (2016) classified construction claims into five major types, namely contractual claims, extra-contractual claims, quantum merit claims, counterclaims, and ex-gratia claims. The results of these studies were based on theoretical literature reviews and personal experience. Al Mohsin (2012) in a study in Oman identified three types of construction claims, namely common law claims, ex-gratia claims, and contractual claims. The results of this study were also based on a theoretical literature review and personal experience of the author. Several attempts were also made to study the magnitude of construction claims. Halloum and Bajracharya (2012) concluded that 93% of the projects experienced cost overrun, and more than 90% witnessed time overrun in Abu Dhai, UAE. Memon, Rahman and Azis (2012) found that 92% of construction projects witnessed time overrun, and 89% of the projects experienced cost overrun. A survey on delay in the Florida construction industry by Ahmed et al. (2003) revealed that the major cause of delay is building permits claims and that 44% of the delays on construction sites are caused by the contractors.

Aibinu and Jagboro (2002), in a survey on the effects of construction delay on project delivery in Nigeria, revealed that cost and time overruns amount to about 18%. Similarly, Omoregie and Radford (2006) used the results of a survey by Mansfield et al. (1994) on infrastructure delays and cost escalation causes and effects in Nigeria. The results indicate that the minimum average percentage escalation of

cost was 14% while the minimum average percentage escalation period of projects was found to be 188%. Shehu et al. (2014) claimed that projects often suffer from cost overruns in Malaysia as approximately 55% of projects were completed above the contract sum. From a detailed literature review, it was found that most of the studies on construction claims are common within the context of the developed world while only a few studies were conducted in Nigeria. Hence, the following questions served as guide for this paper so as to address the identified problems: (1). How frequent are the different types of construction claims? and (2) What are the magnitudes of different types of construction claims?

3. RESEARCH METHODOLOGY

The study adopted a quantitative (statistical) method and archival data were collected from 53 projects that had been completed relating to construction claims. Rowley (2002) suggested the use of case study research to assess contemporary events when it is difficult to manipulate relevant behaviour. Rowley (2002) described diverse sources of evidence that are employable in case study research which include documents, artefacts, interviews and observation. In this study, a series of activities including company visits and document analysis were carried out. All the projects considered were constructed over a period of nine years (2006 to 2014) in Ondo State, Nigeria. There were five health services buildings, thirty-four institutional buildings, two residential buildings, three social services buildings and nine office buildings. The information collected on claims contained the activities of both the main and subcontractors. Only 35% of the building projects had more than four floors, while the remaining 65% had fewer than four floors. The costs of the projects ranged from US$1.31 million to US$26.28 million. The assumptions made in the study include (i) the type of claims used as independent variables are linearly related to the original contract sum. This assumption ensures that the variables are linearly related, and violations of this assumption may indicate that non-linear relationships exist among variables; (ii) change in project characteristics and specifications do not materially affect the relationship between the types of claims and original contract sums. The reason for this is that although the claims may be as a result of the change, the focus is mainly on claims and not on the cause. Percentile ranking was used to assess the frequency and magnitude of various types of construction claims while Pearson's correlation was employed in evaluating the relationship between the magnitude of various types of construction claims and the original contract sum or for testing the null hypothesis.

The percentage of occurrence (POC) of different types of claims is calculated by dividing the summation of projects with a particular type of claim by the summation of number of occurrences of different types of claims and the result is multiplied by 100:

$$POC = \frac{\Sigma P}{N}$$

where ∑P = the summation of number of projects with that type of claim and N = the summation of the number of occurrences of different types of claims = 138. For example in Table 1, the frequency of different site condition claims = 46/138*100 = 33.33%.

The relationship between the magnitudes of claims and average initial cost is expressed as the average claim for each type of claim divided by the average initial cost and the result multiplied by 100

$$R = \frac{AC}{AIC}$$

where AC = average claims for a particular type of claim and AIC = average initial costs for the number of projects with the claims. For example, in Table 2, contract ambiguity claims = 0.169/1.227*100 = 13.77%.

Table 1: Frequency of different types of construction claims

Types of claims	Frequency	Percentage	Rank
Different site condition claims	46	33.33	1
Change claims	43	31.16	2
Contract ambiguity claims	33	23.91	3
Extra works claims	13	9.42	4
Acceleration claims	3	2.18	5
Delay claims	0	0.00	6
Total	138	100.00	

In evaluating the relationship between the magnitudes of various types of construction claims and the project contract sums, Pearson's moment correlation coefficient was adopted since the data are numeric and the data set is not categorical (i.e. classifying subjects in predefined 'classes'). Also, Pearson's correlation was used to support the underline assumption of a linear relationship between dependent and independent variables. This statistical technique measures the strength of the relationship between the dependent and independent variables. According to Lakin (2011), a measure of correlation will take a value between - 1 and +1, where +1 represents perfect positive correlation, -1 represents perfect negative correlation, and values in between the range represent varying levels of correlation (including 0 where there is no correlation at all). The value such as 0.9 represents a very strong positive correlation, a value such as – 0.5 represents a moderate negative correlation, and so on.

4. FINDINGS AND DISCUSSION

The data obtained from the 53 construction projects were processed to achieve the aim of this research and the results are presented in this section. Table 1 shows that claims associated with different site conditions occurred in 46 projects which is 33% of the total occurrences and is ranked first, while change claims occurred in 43 projects which is 41% of the total occurrence and is ranked second. The table also indicates that contract ambiguity claims occurred in 33 projects which is 24% of the total occurrences and is ranked third while extra work claims occurred in 13 projects which is 10% of the total occurrence and is ranked fourth. Table 1 further indicates that acceleration claims occurred in three projects which is 2% of the total occurrence and was ranked fifth while none of the projects experienced delay claims. Table 1 shows that some of the observed projects did not experience certain types of claims which is the reason why the highest frequency is less than the total number of projects (53). It can be deduced that differing site conditions accumulate more claims than other types of claims. In addition, delay in construction projects seemingly attracts few or no claims in the study area.

Table 2 indicates that the amount of contract ambiguity claims is 13.77% of the original contract sum and is ranked first. This may be as a result of pressure to meet with bidding time or deliberate action to underbid many competitors with the intention of subsequently recovering costs through the instrumentation of claims. The amount of change claims is 6.07% of the original contract sum and is ranked second. Change is inevitable in most construction projects in Nigeria which may be due to unstable economic conditions as well as clients' desire. The result also shows that the amount of different site condition claims is 2.27% of the original contract sum and is ranked third while the amount of extra works claims is 2.18% of the original contract sum and is ranked fourth. The result further indicates that the amount of acceleration claims is 1.05% of the initial contract sum and is ranked fifth while the overall claimed amount averaged 25% of the original contract sum.

Table 2: Relationship between magnitudes of claims and average initial cost**

Types of claim	Average claim (USD$) Million	Percentage (%)	Rank
Contract ambiguity claims	0.169	13.77	1
Change claims	0.074	6.03	2
Different site conditions claims	0.028	2.28	3
Extra work claims	0.027	2.20	4
Acceleration claims	0.013	1.06	5
Delay claims	0.000	0.00	6
Overall average %		25.34	

**Note: The average initial cost = US$ 1.227 million

Table 3 presents the results of a correlation analysis for the relationship between the original contract sum and various types of claims. Using Pearson's correlation, the relationship between the original contract sum and change claims, acceleration

claims, different site conditions claims and contract ambiguity claims revealed a p-value of 0.000 (correlation coefficient of 0.820, 0.773, 0.499 and 0.870 respectively) as indicated in Table 3. This shows that the relationship is significant at a 1% level of significance. The relationship between the original contact sum and extra work claims also revealed a p-value of 0.021 (correlation coefficient of 0.822). This implies that the relationship is significant at a 5% level of significance. This implies that there is a positive relationship between the original contract sum and various types of claims. The null hypothesis was therefore rejected.

Table 3: Correlation between original contract sum and construction claims

Original Contract Sum	Pearson Correlation	1	.820**	.773**	.499**	.870**	.021
	Sig. (2-tailed)		.000	.000	.000	.000	.882
Change Claims	Pearson Correlation	.820**	1	.939**	-.011	.472**	-.029
	Sig. (2-tailed)	.000		.000	.935	.000	.838
Acceleration Claims	Pearson Correlation	.773**	.939**	1	-.076	.446**	.208
	Sig. (2-tailed)	.000	.000		.587	.001	.136
Differing Site Claims	Pearson Correlation	.499**	-.011	-.076	1	.795**	.025
	Sig. (2-tailed)	.000	.935	.587		.000	.861
Contract Ambiguity Claims	Pearson Correlation	.870**	.472**	.446**	.795**	1	-.032
	Sig. (2-tailed)	.000	.000	.001	.000		.820
Extra Works Claims	Pearson Correlation	.021	-.029	.208	.025	-.032	1
	Sig. (2-tailed)	.882	.838	.136	.861	.820	

**Correlation is significant at the 0.01 level (2-tailed), N = 53

The results of the analysis reveal that the most frequent type of claim is ‘differing site conditions’. This implies that the most commonly occurring claims at construction sites are the alleged ‘differing site conditions’ claims. More often, contractors encounter some conditions at the subsurface level that differ from the evidence contained in the geotechnical report, or other conditions in the field that are different from what was anticipated or illustrated on the plans. Mahfouz, Davlyatov, and Kandil (2016) posited that differing site conditions is considered to be one of the most prominent reasons for claims within the construction industry. In some cases, documents used for past projects are transferred to current projects without proper alignments which eventually give room for claims as a result of variations in site conditions. This, according to Sambasivan and Soon (2007), was described as lack of

adequate site inspection and omission of the necessary geotechnical survey prior to preparation of contract document. This is in contrast with what was obtained in United Arab Emirates where Zaneldin (2006) observed that the most frequent type of claim was changes claims while Fonseka (2008) later found out that delay claims was most frequent. It can be deduced that occurrence of certain claims is relative to locations. For instance, projects in some locations with good and similar topography may necessarily not attract claims with regard to site conditions as applied in this study. Occurrence of claims may also be as a result of design errors, different interpretations of contract documents or incomplete specifications as identified by Apte and Pathak (2016).

The study also revealed that overall construction claims averaged 60% of the average initial cost. Having additional cost as a result of claims, running above half of the initial contract sum is worrisome. Chigara et al. (2013) argued that construction project cost is one of the most difficult issues to manage. Contractors are mainly businessmen, and bidding is a kind of business in which contractors are usually hard-pressed for time and are determinedly looking for a way to underbid a number of competitors. As a result, they may not be able to promptly fix out ambiguities in the contract documents prior to bidding. Consequently, their estimate is based only on certain costs which they think the contract terms will allow the clients to insist upon to ascertain performance. However, the claim on the ground of contractual ambiguity may not be granted in favour of the contractor if the ambiguity was so noticeable and glaring as to necessitate the contractor to request explanation prior to bid submission. One of the likely effects of this will be project abandonment, especially when the owner could no longer fund the project owing to excessive claims. This is a pointer to the reason why project abandonment is prevalent in Nigeria (Olusegun & Michael, 2011). Within the period of one decade (between 2006 and 2016), construction claims in Nigeria seem to have escalated, comparing the finding from this study with previous finding by Omoregie and Radford (2006) who observed that costs of projects in Nigeria increased by a figure of 14%. Purposeful tender that satisfies the clients' requirements should be considered for the award of contract rather than the 'lowest responsive tender' as currently stipulated by the Public Procurement Act of 2007 in Nigeria. This is to discourage the award of contract to contractor that based his bid on opportunistic behaviour which will result in excessive claims during the execution of the contract.

The result of Pearson's correlation shows that a strong positive relationship existed between the original contract sum and both change claims and contract ambiguity claims. The implication of this is that most changes introduced after the contract has been awarded do attract additional cost. There are different factors responsible for change in construction projects as discussed by Sun and Meng (2009). Contract ambiguity-related claims also correlate significantly with the original contract sum. When the contract is poorly written by the quantity surveyor

or any other cost expert, it will create room for claims by the contractor which will invariably affect original contract sum. This is in agreement with the opinion of Zaneldin (2006) who posited that contract ambiguity could attract significant claims in construction projects. The result indicates that a positive relationship exists between the original contract sum and acceleration claims. Also, the relationship between differing site conditions claims and original contract sum is positively significant. In the event of unforeseen circumstances that delay the job and shorten the contractor's completion time or when the project owner requires the contractor to complete the work preferably earlier than initially scheduled, acceleration claims can be accrued. In agreement with Ahmed et al. (2002), acceleration claims can bring about additional cost in construction projects.

Unexpected site conditions can be the most bothersome, complicated, and costly problems to overcome on a construction project. In spite of great advancements in technology, Nelson (2016) posited that existing utilities are often wrongly positioned in the plan, underground boulders are sometimes larger than what they represented in the geotechnical report, and soils are more saturated than boring tests had revealed. In addition, the discovery of buried human remains during earthwork can cause significant delays. This is particularly relevant here in Nigeria where tribal graves are rarely identified prior to construction works. Although a 'changed conditions clause' is normally introduced in the contract to give room for non-adversarial claims, contractors could forfeit their claims if it is established that proper site investigation was not carried out prior to bidding. It is therefore recommended that site investigation and adequate planning should be carried out in order to reduce the frequency of different site conditions claims. The result further indicates that there is a weak significant relationship between the original contract sum and extra works claims. This could be as a result of the type of contract used for the identified projects. Claims for extra works done by the contractor are guided by the types of contract (Cunningham, 2014). For instance, under a re-measurement contract, claims can be made on extra works without formal instruction prior to work execution, hence there could be more claims than necessary. However, under lump-sum fixed contract, a formal instruction is needed to claim for extra work done by the contractor which limits the number of claims to a reasonable extent. Therefore it can be inferred that more lump-sum contracts were used for the case projects than re-measurement contracts.

5. CONCLUSION AND RECOMMENDATION

Claim in construction projects is one of the critical risk factors that could significantly influence a construction project's cost and time. If project parties ignore this risk, it may cause adversarial relationships and consequential losses. Claims can adversely affect construction project participants by resulting in bankruptcy, lack of

trust or dispute if not properly managed. Hence, in the common interest of all participants it is necessary to forestall the claims from the inception and to minimize them if they eventually arise. This study aims to raise a consciousness of claim potential so that proactive action can be taken regarding claim management. In this paper, six types of claims were identified through the literature review and verified through 53 real-life projects. The most frequent type of claim is related to different site conditions, followed by changes claims while none of the projects used for the study experienced any delay claims. Projects with contract ambiguity had the highest amount of claim while the claims of projects with different site conditions, even though they occur more frequently than other types of claims, accrue lesser amounts of claim in terms of cost. It is expected that claims relating to differing site conditions should attract more claims costs contrary to the finding in this study. This may point to the numbers of such claims that are successful in favour of the contractors. This could also explain the reason why some projects are abandoned in the Nigerian construction industry. The study also revealed that the overall amount claimed by the contractors was more than half of the original contract sum. Thus, the impact of claims on the cost performance of construction projects in the study area is significant. Identification of these claims supports efforts to understand their sources and influence on construction projects.

The findings also provide a better understanding for construction project stakeholders of the importance of early management of risks that could lead to claims during project execution. This understanding enables the enhancement of strategies, approaches, and tools for the better management of construction projects. Given the realisation of the occurrence and influence of different types of claims, the strategies to be employed should be implemented in the planning process during the early stage of a project. The understanding also enables estimators, project owners, and contractors to promptly recognise specific claims that could impact a project in order to mitigate the impact and to establish precise and realistic expectations. Hence, the claims that were significantly correlated to the original contract sum should be considered as core determinants in estimating the cost of uncertainty associated with building projects.

Though the findings are based on archival data from Nigeria, the results are similar to studies conducted in other developing and some developed countries. By giving balanced and sustained attention to the identified claims, and variations between initial project cost and final cost, a prevailing and worrying situation in Nigeria and other countries can be minimised in order to save costs in construction projects. While this study has provided useful information regarding construction claims, care must be taking in interpreting the findings owing to some limitations. For instance, findings from this study are drawn from archival data without considering the causes of the identified claims in relation to the case projects. Another limitation is associated with the assumption of a linear relationship among the variables relationships. It is recommended that future research explores further factors responsible for each of the identified claims as well as exploring a statement neutralising or negating the assumption. Such studies would enable the isolation of the key issues that must be put in place to minimise the occurrence of claims.

6. REFERENCES

Ahmed, S. M., Azhar, S., Castillo, M. & Kappagantula, P. (2002). *Construction delays in Florida: An empirical study. Final report*. Department of Community Affairs, Florida, US.

Ahmed, S. M. Azhar, S. Kappagantula, P. & Gollapudi, D. (2003). Delays in construction: A brief study of the Florida construction industry. In: *Proceedings of the 39th Annual Conference of American Society of Civil Engineers*.

Aibinu, A. A. & Jagboro, G. O. (2002). The effects of construction delays on project delivery in Nigerian construction industry. *International Journal of Project Management*, 20(8): 593-599.

Al-Mohsin, M. A. (2011). Claim analysis of construction projects in Oman. *International Journal on Advanced Science, Engineering and Information Technology*, 2(2): 73-78.

Apte, B. & Pathak, S. (2016). Review of types and causes of construction claims. *International Journal of Research in Civil Engineering, Architecture and Design,* 4(2): 43-50.

Asiedu, R. O. & Alfen, H. W. (2014). Factors engendering cost misrepresentation of public sector projects in Ghana. *International Journal of Sustainable Construction Engineering and Technology,* 5(2): 13-24.

Chigara, B., Moyo, T. & Mudzengerere, F. H. (2013). An analysis of cost management strategies employed by building contractors on projects in Zimbabwe. *International Journal of Sustainable Construction Engineering and Technology,* 4(2): 1-13.

Chovichien, V. & Tochaiwat, K. (2006,). Information system for managing employer's construction claims. In: *Proceedings of Technology and Innovation for Sustainable Development Conference (TISD2006)*, Faculty of Engineering, Khon Kaen University, Thailand, 25-26 January.

Cunningham, T. (2014). *Contractors' claims for loss and expense under the principle 'traditional' forms of Irish building contract*. Other resources. 31. Available online at: http://arrow.dit.ie/beschreoth/31

Ezekwesili, (2005). *Due process mechanism and digital opportunity*. Paper presented to the university community at Prices Alexandra Auditorium, University of Nigeria, Nsuka. Available online: http://www.holleafrica.com/showArticle php? article=248&catld6. [Retrieved 21 August 2014].

Federal Republic of Nigeria. (2007). *Public Procurement Act*. Official Gazette. Act No. 14, Vol. 94: A205-249.

Fonseka, W.M.H.R. (2008). *Construction claims in United Arab Emirates: Causes, types, frequency and how to minimise*. Unpublished MSc. thesis, Heriot-Watt University, Edinburgh, Scotland, UK.

Halloum, M. A. & Bajracharya, A. (2012). Cost and time overruns revisited: A study on the infrastructure construction in Abu Dhabi, UAE. In: *Proceedings of 3rd*

International Conference on Construction in Developing Countries (ICCDIC – III), 4-6 July, Bangkok, Thailand.

He, Q., Luo, L., Hu, Y. & Chan, A. P. (2015). Measuring the complexity of mega construction projects in China – A fuzzy analytic network process analysis. *International Journal of Project Management,* 33(3): 549-563.

Ho, S.P. & Liu, L.Y. (2004). Analytical model for analysing construction claims and opportunistic bidding. *Journal of Construction Engineering Management,* 130 (1): 94-104.

Kahssay, G. (2003). *Claims in international projects in Ethiopia*. Published doctoral thesis submitted to the Addis Ababa University, Ethiopia.

Khekale, C. & Futane, N. (2015). Management of claims and disputes in construction industry. *International Journal of Science and Research (IJSR)*, 4 (5): 848-856.

Lakin, S. (2011). How to use statistics (5th ed.). Essex, UK.: Pearson Education.

Leegard P. E. (2011). Construction claims. In: *Proceedings of Metro State Aid Construction Training Seminar*, 2 March, Ireland.

Mahfouz, T., Davlyatov, S. & Kandil, A. (2016). Analysis of differing site condition (DSC) litigation reasoning through statistical modeling. *International Journal of Construction Education and Research,* 12(4): 285-302.

Mansfield, N.R., Ugwu, O.O. & Doran, T. (1994). Causes of delay and cost overruns in Nigerian construction Projects. *International Journal of Project Management,* 12(4): 254-260.

Memon, A. H., Rahman, I. A. & Azia, A. A. A. (2012). Time and cost performance in construction projects in South and Central Regions of Peninsular Malaysia. *International Journal of Advances in Applied Sciences*, 1(1): 42–52.

Mohamed, K. A., Khoury, S. S. & Hafez, S. M. (2011). Contractor's decision for bid profit reduction within opportunistic bidding behavior of claims recovery. *International Journal of Project Management*, 29(1): 93-107.

Moura, H. & Teixeira, J.C. (2007). Types of construction claims: A Portuguese survey. In: *Proceedings of 23rd Annual Conference of Association of Researchers in Construction Management (ARCOM),* 3–5 September, Belfast.

Nelson, C. (2016). Differing site conditions on Washington State construction projects. *Paper presented by Foster Pepper PLLC.* Accessed online: http://www.foster.com/documents/construction-webinars/differing-site-conditions.pdf .[Retrieved 17 July 2016].

Obiegbu, M. E. (2005). Overview of total performance concept of buildings: Focusing on quality, safety, and durability. In: *Proceedings of the 35th Annual Conference of the Nigerian Institute of Building,* pp. 27-28.

Ogunsemi, D.R. (2002). *Cost and time performance of construction projects in south-western Nigeria.* Unpublished PhD thesis, submitted to the Federal University of Technology, Akure, Nigeria.

Oladapo, A. A. (2007). A quantitative assessment of the cost and time impact of

variation orders on construction projects. *Journal of Engineering, Design and Technology*, 5(1): 35-48.

Olusegun, A. E. & Michael, A. O. (2011). Abandonment of construction projects in Nigeria: Causes and effects. *Journal of Emerging Trends in Economics and Management Sciences,* 2(2): 142-145.

Omoregie, A. & Radford, D. (2006,). Infrastructure delays and cost escalation: Causes and effects in Nigeria. In: *Proceedings of sixth International Postgraduate Research Conference,* Delft University of Technology and TNO, Netherlands, 3-7 April.

Oyewobi, L. O., Ganiyu, B. O., Oke, A. A., Ola-Awo, A. W. & Shittu, A. A. (2011). Determinants of unethical performance in Nigerian construction industry. *Journal of Sustainable Development*, 4(4): 175-182.

Ren, Z., Anumba, C. J. & Ugwu, O. O. (2003). The development of a multi-agent system for construction claims negotiation. *Advances in Engineering Software,* 34(11): 683-696.

Rowley, J. (2002). Using case studies in research. *Management Research News*, 25(1): 16-27.

Sambasivan, M. & Soon, Y. W. (2007). Causes and effects of delays in Malaysian construction industry. *International Journal of Project Management,* 25(5): 517-526.

Shehu, Z., Endut, I. R., Akintoye, A. & Holt, G. D. (2014). Cost overrun in the Malaysian construction industry projects: A deeper insight. *International Journal of Project Management,* 32(8): 1471-1480.

Singh, K.S. & Kandan, K. (2005). *Variation claims – Pitfalls and pratfalls.* Available online:
http://www.bem.org.my/publication/dec04feb05/e%26l(variation)36-42pdf
[Retrieved 7 April 2014].

Sun, M. & Meng, X. (2009). Taxonomy for change causes and effects in construction projects. *International Journal of Project Management,* 27(6): 560-572.

Yates, J. K. & Epstein, A. (2006). Avoiding and minimizing construction delay claim disputes in relational contracting. *Journal of Professional Issues in Engineering Education and Practice*, 132(2): 168-179.

Zaneldin, E. K. (2006). Construction claims in United Arab Emirates: Types, causes, and frequency. *International Journal of Project Management*, 24(5): 453-459.

EFFECTS OF INACCURATE COST ESTIMATE ON CONSTRUCTION PROJECT STAKEHOLDERS

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ABSTRACT

The aim of this paper is to assess the effects of inaccurate cost estimates on construction project stakeholders in order to establish mitigation measures. The paper reviewed literature relating to cost estimation and the empirical data was obtained through a structured questionnaire. Furthermore, the study involved convenient purposive sampling of construction professionals working in quantity surveying practices and construction firms within and around Cape Town. A quantitative approach was used to conduct the study and data were reported using central tendency descriptive statistics. The findings revealed inaccurate cost estimates resulting in loss of reputation and credibility of project stakeholders, risk exposure, and financial loss as the effects of inaccurate cost on construction projects. In view of the confidential nature of some project costs in the private construction sector, the research experienced limitations in gathering statistics on the actual extent of projects that were underestimated or overestimated for comparative studies on private sector projects. The study draws the attention of construction project stakeholders to the negative effects and consequences of inaccurate cost estimation in order to proffer a mitigating mechanism.

Keywords: Accuracy, Cost estimate, Cost overrun, Construction project, Project stakeholders, Underestimation

1. INTRODUCTION

Since construction project cost estimation has been viewed as a mere budgetary allocation, its accuracy remains uncertain, and this often causes a gap between the initial project cost and completion cost. Unfortunately, little attention has been given to the shortcomings that emanate from inaccurate cost estimation, including the centring factors and effects. The effects of inaccurate cost estimation are unnecessary risk, financial loss, loss of reputation and credibility of estimator, and a rise in claims and dispute (Flyvbjerg et al., 2002; Mahamid & Dmaidi, 2013). According to Flyvbjerg et al. (2002), cost underestimation appears to exist as a global norm and occurs on construction projects ranging from infrastructure to other types of projects. Cost performance has an effect on the successful delivery of construction project in many areas which give rises to cost overrun, claims and dispute. Hicks, as cited by Akintoye (2000), in emphasising the importance of cost estimate, reveals that without an accurate cost estimate, nothing short of an act of God can prevent a loss, regardless of management competence, the financial strength of the contractor, or know-how.

In order to avert inaccurate cost estimation, improvement in the costing concept tends to be the consensus. However, the studies of Flyvbjerg et al. (2002) on transport infrastructure projects across twenty countries around five different continents reveal that there has been precisely no improvement in the accuracy of cost estimates over seventy years; thus inaccurate cost estimation persists in the construction industry. Various studies identify the problems of inaccurate project cost to include human error and the competence of cost professionals (Nijkamp & Ubbels, 1999; Flyvbjerg et al., 2002; Doloi, 2013). The primary aim of project stakeholders is to achieve good value for money; however, with the prevalence of inaccurate cost estimation on construction projects, these objectives are rarely achievable and this will expose project stakeholders to risk, damages, loss of reputation, financial loss, disputes and claims. The aim of this paper is to identify the effects of inaccurate cost estimation and its implications for construction project stakeholders in order to establish a mitigating mechanism. While empirical data have been collected, the literature relating to the accuracy of estimation, including tools and techniques for cost estimation, factors influencing the accuracy of cost estimate, and the effects of inaccurate cost estimation, was reviewed.

Inaccurate cost estimates have significant effects on project delivery, and thus give rise to cost overrun, claims and disputes on construction projects. The awareness drawn from the study can be used as a template for identifying a mitigating mechanism of inaccurate cost estimation for project stakeholders, especially the estimators and contractors.

2. LITERATURE REVIEW

2.1 Estimating variables to produce accurate estimates

Skitmore (1990) identifies bases of estimate generation on variables such as items, quantities, and rates. The accuracy of the combination of these variables has a resultant effect on the accuracy of the cost estimate. In essence, it is important to specify the right item and apply correct quantities with appropriate rates to arrive at an accurate estimate. Morrison (1984) indicates that the accuracy of a cost estimate predicts the degree of the quantity surveyor's efficient performance and detailed estimating technique employed for the budgeted cost. Al-Hasan, Ross and Kirkham (2006) indicate that in order to derive a more accurate cost estimate, a more sophisticated estimating technique is required to be developed and used in estimating project cost. Nichols (2007) identifies inconsistence in the estimating techniques of estimators, as well as the lack of a clear definition of purpose, scope and contents during the production process of cost estimate. Azman and Samad (2011) maintain that continuous training, the acquisition of knowledge and skills, and improving the estimating technique of the estimator regarding modern technology will fine-tune the inadequacy of cost performance on construction projects. According to Skitmore (1988), several factors associated with the accuracy of cost estimates in terms of bias and the consistency of the estimator are the state of the market and the location of the project. Akintoye (2000) affirms the factors that relate to the accuracy of the cost-estimating practice as the complexity of project, the scale and scope of construction, the market conditions, the method of construction, site constraints, the client's financial position, buildability and the location of the project. In addition, Olatunji (2012) asserts that the utilization of information technology (IT) advancement and modern business behaviour that integrates innovation as a means of improving accuracy in estimating practice are essential. The Royal Institute of British Architects (RIBA) established construction work stages in relation to Royal Institute of Chartered Surveyors' (RICS) order of cost estimates. The different stages of construction require a suitable technique of estimate, and these estimates are developed in detailed form as the stages of work progress, with more information and planning intensity (RICS, 2012). Hence, in order to avoid inaccurate cost estimation, an improved cost estimating concept is paramount.

2.2 Tools and techniques for cost estimation

Seeletse and Ladzani (2012) reveal that inadequacy in cost concept, scheduling tools, risk management and price estimation are common in project cost estimation. Stewart (1991) highlights the basic tools for estimating such as information, method, schedule and skills.

- Information: Every cost estimate should include detailed and complete information concerning the process, product, project and service being estimated. In construction projects, the information is based on many forms to include drawings, specifications, historical cost data, labour and workmanship, material, plant, supervision, establishment, specialist services, levies and taxes. The greater the amount of project information available, the greater will be the reciprocal effect on the accuracy of cost estimate (Skitmore, 1987).
- Method: There are different methods of estimation. Depending on the timing, stages and degree of accuracy required, a suitable method of estimation should be carefully considered.
- Schedule: This is a tool that is required to develop the estimate. Details of the timing of activities and completion dates should be planned and incorporated into the scheduling tool in order to highlight the phases of the estimating cycle.
- Skills: Different skills are required in the relevant areas relating to the project cost estimate. It is important to acquire the necessary skills, either individually or collectively, in order to achieve a viable or accurate estimate.

Skitmore, Stradling and Tuohy (1994) propose that the skill of the estimator is a key dependant in the practice of forecasting construction price. This is associated with other factors which affect the quality of cost estimates such as information, technique and expertise of forecaster. The Project Management Institute (1996) categorises tools and techniques for cost estimating into analogous estimating, parametric estimating, and bottom-up estimating, including computerized tools.

- Analogous estimating: Also called top-down estimating, this estimating technique uses the actual cost of a similar or pervious project as the basis for estimating. This is used in the early stage of project planning when a limited amount of information is available. Analogous estimating is in the form of expert judgement, when previous projects are similar in appearance to a new project that needs to be estimated.
- Parametric estimating: This technique of estimating is when project parameters (characteristics) in a mathematical model are used such as per square meter of residential building or per unit beds of hospital.
- Bottom-up estimating: This technique of estimating is derived from the cost of individual work items summarized to obtain the project cost.
- Computerized tools: These estimating tools such as project management software and spreadsheet are used in assisting with cost estimating. Such products simplify the use of the techniques mentioned above.

According to Olatunji (2012), estimators are moving beyond the conventional estimating procedure towards an information technology (IT)-based estimating procedure such as CAD-enabled or BIM-enabled. As the IT-based solution increases, estimators need to develop their skills beyond the conventional estimating procedure. A diverse range of expertise of forecasters is called for in

different generic building contracts such as educational, medical, industrial, retail, offices, housing and other engineering contracts; hence such expertise is perceived to be specifically focused and suggests a difference in the forecasting processes of different types of projects. The expertise of the cost estimator does not cut across a wide range of project types (Skitmore et al., 1994).

2.3 Factors influencing accuracy of cost estimate

The choice of estimate depends on several factors such as the end-use of the estimate, the amount of time and money available to prepare the estimate, the estimate tools, the available data, the project definition, and the project timing (Seeltese & Ladzani, 2012). According to Flyvbjerg et al. (2002), technical, economical, physiological and political factors are considered as explanation for inaccurate cost estimates.

- Technical: This is commonly referred to as a forecasting error. This type of error encompasses imperfect techniques, incomplete data, mistakes, errors in future forecast and inexperience on the side of forecaster.
- Economical: This error is explained in terms of both self-interest and public interest. The engineer and construction company interest in the likelihood of the project being built prompts the rational for an increase in revenue and profit, while public interest provides public officials with incentives to cut costs and save public funds. This explanation would be regarded as deceptive as most public regulations forbid misleading information.
- Physiological: This touches on the mental state, psyche, and bias appraisal of the project stakeholders due to the optimistic plans of the promoters about the successful outcome of the project. Flyvbjerg et al. (2002) indicated a problem with the physiological explanation; however, they concede that appraisal optimism would be a credible explanation of underestimation if the estimate were produced by an inexperienced forecaster. It was concluded that appraisal optimism is deceptive.
- Political: This error factor ascribes interests and power to a political explanation for underestimating cost. The question of deception is further raised in relation to legal, economic and moral reasons. According to Flyvbjerg et al. (2002), forecasters or promoters are not likely to admit to a researcher or others that they have intentionally fabricated the estimate for a project to proceed.

Flyvbjerg et al. (2002) recommend checks and balances in the following areas of transparency, namely the use of performance specifications, the formulation of a regulatory regime and the involvement of private risk capital. In related studies on the accuracy of cost estimates, Pickrell (1990) concludes that cost estimates are highly inaccurate based on error in forecast, with actual costs being typically much higher than estimated costs. Skitmore et al. (1994) deduce that early stage cost estimates by their nature are imprecise. Nijkamp and Ubbels (1999) carried out a

comparative analysis of cost estimates on infrastructure projects in the Netherlands and Finland, the findings of which indicate that cost estimates tend to be fairly reliable. However, on the other hand, Flyvbjerg et al. (2002) contend that there has been no improvement in the accuracy of cost estimates.

2.4 Factors influencing cost change

In examining the factors that influence the cost of projects, Doloi (2013) proposes factors which critically impact on project cost as project planning and monitoring, design efficiency, effective site management, communication, contractor's efficiency, project characteristics, due diligence, and market competition. As projects commence, the prices rarely remain constant as some factors necessitate changes in cost during different stages of the project (European Commission, 1998). Ponte (2009) suggests several factors to be considered when preparing construction cost estimate to include fluctuation of cost, traffic conditions, restrictive work hours or method of work, small quantities of work, separated operations, handwork and inefficient operations, accessibility, geographic location, construction season, and material shortage. Figure 1 illustrates some technical and economic factors which change the cost of a project over time.

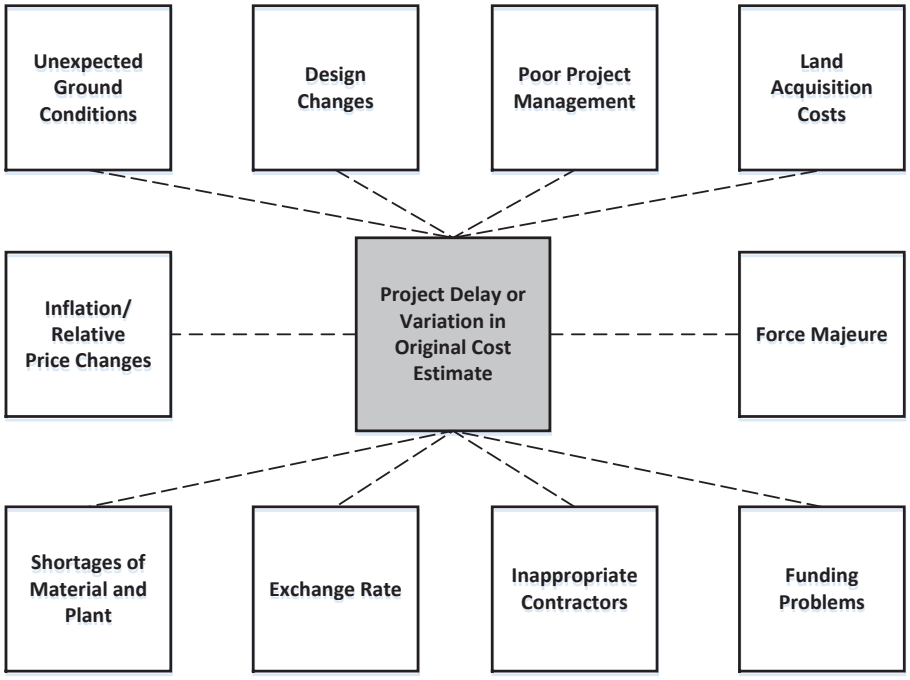

Figure 1: Cost-changing factors
Source: European Commission (1998)

2.4.1 Technical factors

According to Akintoye (2000), the tender sum submitted by the contractor combines the cost estimate and the mark-up. In addition, the mark-up comprises a general allowance for overhead recovery, profit and other indirect costs. Skitmore and Wilcock (1994) in their study noted that contractors estimate a lump sum amount for the complexity of work items based on a subjective decision and experience. This further revealed that behavioural and environmental factors such as personality, motivation, incentives and habit do influence the experiential-based technique of estimating. A high degree of subjectivity is involved in estimating indirect cost during tender price submission. Senior management considers a subjective percentage added to the cost estimate: this subjective decision making is characterised by qualitative data and knowledge that are vague and not easy to quantify (Akintoye, 2000). In addition, Morrison (1984) maintains that factors which influence estimate depend upon the variability of the project which is to be estimated. Skitmore (1887) implies that many estimators, rather than providing accurate cost estimate, provide an imprecise forecast based on the high level of project complexity and uncertainty associated with construction works. Akintoye (2000) sums up the factors that relate to the accuracy of the cost-estimating practice as the complexity of the project, the scale and scope of construction, the market conditions, the method of construction, site constraints, the client's financial position, buildability and the location of the project. In order to achieve accurate estimate in construction projects, the estimator is required to consider significant factors which affect the project cost.

2.4.2 Economic factors

According to Ponte (2009), in arriving at cost estimate, a project estimator should not only consider the scope of work or design which they are estimating. Therefore additional information relating to external factors, which are different from the technical factors, will be deducted as factors which contribute to project cost estimate. Estimators use cost data taken from previous projects as a benchmark of cost estimate. According to Morrison (1984), cost data selected for estimate are adjusted in order to convert the relevant data from the previous time, location and prevailing market situation to the anticipated time, location and market situation surrounding the new project. Seeletse and Ladzani (2012) identify some common cost change concepts as inflation, deflation, escalation, taxation, and currency variation.

- Inflation (price index): According to Ashworth and Skitmore (1983), the type of index used for updating the historical cost data affects the accuracy of estimate. Inflation of cost has a significant effect on the cost of a project, similar to the time value of money, and should be carefully considered when calculating cost estimate.

- Economic cycles (market conditions): This refers to the fluctuation of the economy between periods of expansion (growth) and contraction (recession). These are changes in the economic situation of a nation. Ashworth and Skitmore (1983) contend that market conditions are considered to have an effect on the accuracy of estimate. Cost professionals make logical reference to these changes when providing cost advice.

In Figure 2 Danto (2013) illustrates the different economic cycles which have a significant effect on the demand and supply of construction industry, which in turn impacts on the costing of a project.

- Growth: This is manifested in an increase in demand for construction, reduced competition, increased profit, reduced resources, increased prices, and contractors insisting on fair conditions.
- Peak: This is demonstrated by a demand increase, little competition, high profit margin, resource long delay, resources exceeding the budget and every one becoming a builder.
- Recession: This is characterised by the demand weakening, competition increasing, profit margins declining and resource costs being reduced.
- Trough (narrow depression): During a trough there is a high rate of competition, profits are discounted, resources are not readily available, and the industry is fragmented, but building conditions are good and productivity is high.

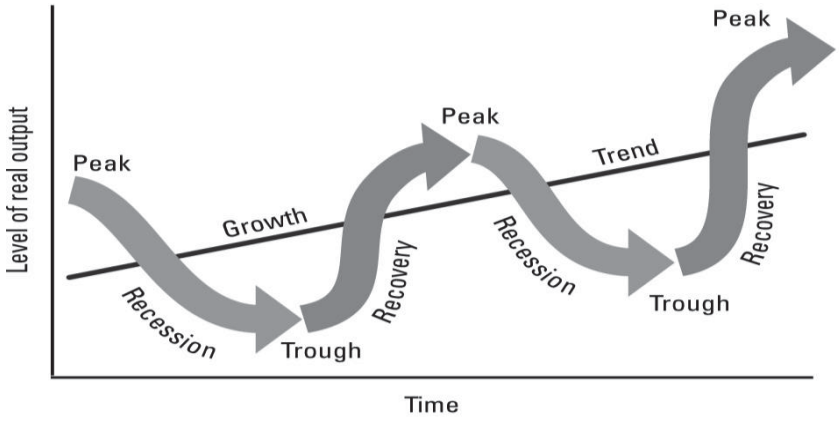

Figure 2: Economic cycles
Source: Danto (2013)

2.5 Effects of inaccurate cost estimation

Gupta (2009) explains the similarities between cost underestimation and cost overrun. Cost underestimation is the act of assessing (planning) the cost of a project lower than what the actual cost turns out to be after implementation, while cost overrun is the excess of the actual cost over budget. Cost underestimation

occurs at the planning stage and cost overrun occurs at or towards the final stage: therefore both occurrences represent inaccurate cost estimation. Mukuka, Aigbavboa and Thwala (2014) highlight the consequences encountered by stakeholders in the construction industry as a result of inaccurate cost estimation in respect of the following:

- The client: added cost over the budget agreed upon and less return on investment;
- The end user: additional cost passed on rental or lease cost or prices;
- The design team and professionals: inability to deliver value for money which results in loss of reputation or loss of confidence by client;
- The contractor: loss of profit. If at fault, it would imply further damages that could jeopardise chances of getting additional jobs; and
- The industry as a whole: brings project abandonment and a drop in building activities, bad reputation, and the inability to secure finance or securing finance at higher cost due to risk exposure.

2.5.1 Loss of reputation and credibility

Cheung, Wong and Skitmore (2008) maintain that clients have little tolerance for cost underestimation. In their study on clients' and estimators' tolerance towards estimating error, it was reported that clients are more tolerable to overestimation than underestimation because cost underestimation leads to severe effects. Skitmore and Cheung (2007) suggest that overestimating a project cost estimate seems to be a medium of risk reduction for the estimator in order to preserve their reputation with the client. Cheung et al. (2008) conclude that estimators or quantity surveyors perceive estimating error as something to be eliminated rather than minimised.

2.5.2 Risk exposure

The techniques of risk management commonly used by contractors are judgement and experience, sensitivity analysis and risk premium insurance (Akintoye & MacLeod, 1997). According to Mahamid and Dmaidi (2013), cost overruns have negative effects on project stakeholders, especially clients, contractors and consultants, and lead to adversarial relationships, cash flow problems, claims, mistrust, arbitration, litigation, and a general feeling of apprehension towards each other. Akintoye and MacLeod (1997) highlight several ways in which construction risk can be transferred such as to subcontractors, through contractual terms, to design teams and consultants, to the client, to insurance, and to the contractor. Most forms of construction contracts transfer the majority of construction risks to the contractor, hence it is important for a contractor to manage risk in an effective way to avoid consequences such as loss of profit, claims, litigations, injuries, and damage to property. Nijkamp and Ubbels

(1999) highlight risks that influence the cost of a project, making it difficult for estimators to derive accurate cost estimates:

- Political risks, such as changes in transport policy or regulations by the government;
- Financial risks, such as fluctuations in interest rates and exchange rates, and false expectations about inflation;
- Construction risks, such as delays, unexpected and higher or lower costs;
- Operational risks, such as damage by accidents and vandalism; and
- Commercial risks, such as wrong cost estimates or wrong forecasting.

2.5.3 Financial loss

Gunner and Skitmore (1998) maintain that estimators unavoidably make errors in such a way that forecasts are positively biased, thus overestimating the actual price, and negatively biased, thus underestimating the actual price. Akintoye (2000) emphasises the negative impact of both overestimated cost and underestimated cost, and notes that while overestimated costs result in a higher tender price and a tender being unacceptable to a project owner and the loss of work to contractor, underestimated costs lead to situations where project contractors incur losses. According to Flyvbjerg et al. (2002), the strategic misrepresentation which is attributed to cost underestimation leads to misallocation of scarce resources, thus effectively causing a loss to those financing the project, and bearing a negative effect on the end users of the project.

3. METHODOLOGY

3.1 Research approach

In conducting the research, a quantitative research method was adopted where data were collected using a structured questionnaire through an online SurveyMonkey. Quantitative research is considered to be the classic scientific approach to doing social science research. It involves the generation of data in quantitative form which is subjected to accurate quantitative analysis (Kothari, 2004). The questionnaire was developed and divided into different sections. The first section related to the general information of respondents and the second part related to research data collection on the effects of inaccurate cost estimation. The questions focused on the following areas: loss of reputation and credibility of project stakeholders, exposure to risk, and financial loss as the effects of inaccurate cost estimation.

3.2 Population and sampling

According to Babbie (2013), purposive sampling is a type of non-probability sampling in which the researcher selects the units to be observed based on judgment about which sample will be the most useful or representative. Owing to the different range of attributes, behaviours and experience of respondents, a purposive sampling technique was adopted. A total of one hundred and forty-two (142) emails were sent by means of a survey website link. The respondents were selected from the available register of the South African Council for Quantity Surveying Professions (SACQSP), general building contractors registered with the Construction Industry Development Board (CIDB), construction professionals working in quantity surveying practice and construction firms within and around Cape Town. A high response rate of 52% was recorded, which accounts for seventy-four (74) respondents who completed and returned the questionnaire. The survey was open for one month: during this period reminder emails were sent out online through the web link: https://www.surveymonkey.com/r/X7S3FW8. The online survey and reminders accounted for the high response rate.

3.3 Data processing and analysis

The questionnaire for the study was designed to generate statistics for quantitative data. In designing the rating scale for the questions, a five-point Likert scale was used and the respondents were asked to rate the importance of the different variables relating to loss of reputation and credibility of project stakeholders, exposure to risk and financial loss as effects of inaccurate cost estimation where 1 = insignificant, 2 = little significance, 3 = fairly significant, 4 = significant, 5 = very significant. Analysis of data involved closely-related operations conducted in a manner that summarised and organised the collected data in order to yield answers to the research questions (Kumar, 2008). Data were inputted and analysed on the computer using Statistical Package for Social Sciences (SPSS). The quantitative data gathered were analysed using descriptive statistics. In analysing the research data, the measures of central tendency using mean value were used to analyse the data.

4. FINDINGS AND DISCUSSIONS

4.1 Profile of respondents

The selected respondents work in the private sector and public sector, while some work in both sectors as indicated in Table 1. The majority, namely 73% of the respondents, work in the private sector, 10.8% work in the public sector, while 16.2% of the respondents work in both private and public sectors. These data

suggest that the respondents possess a blend of experience in both private and public sectors.

Table 1: Working sector of respondents

Respondents' working sector	N	Percentage (%)
Private	54	73.0
Public	8	10.8
Both	12	16.2
Total	74	100.0

The results indicated that the respondents had adequate educational qualifications. The majority, namely 97% of the respondents, had acquired a minimum of a bachelor's degree as indicated in Table 2.

Table 2: Respondents' formal qualification

Respondents' formal qualification	N	Percentage (%)
Diploma	1	1.4
BTech degree	5	6.8
BSc degree	9	12.2
BSc Honours	21	28.4
Master's	27	36.5
Doctorate	10	13.5
Others	1	1.4
Total	74	100.0

4.2 Reliability of research instrument

Tests on the reliability of the research instrument were conducted based on Cronbach's alpha coefficient value. According to Lakshmi and Mohideen (2012), the coefficient alpha method is the most common method of attaining consistent reliability. Cronbach's alpha is the average of all possible split-half estimates which measure inter-item reliability or the degree to which items measuring variables attain constant results. Table 3 presents the overall Cronbach's alpha coefficient value for the total questions which was 0.93, which indicates an excellent result. According to George and Mallery (2003), the following rules on the degree of reliability indicate > 0.9 to be excellent, > 0.8 to be good, > 0.7 to be acceptable, > 0.6 to be questionable, > 0.5 to be poor, and < 0.5 to be unacceptable. Test on the reliability of the research instrument were conducted based on Cronbach's alpha coefficient value, the result of which shows a coefficient value 0.95 which indicates that the reliability of the research instrument is found to be satisfactory.

Table 3: Consistence reliability for scale items

Research variables	Number of items	Cronbach's alpha coefficient values	Degree of reliability
Loss of reputation and credibility	10	0.95	Excellent
Exposure to risk	7	0.88	Good
Financial loss	12	0.95	Excellent
All questions combined	29	0.93	Excellent

4.3 Effects of inaccurate estimates

4.3.1 Loss of reputation and credibility

Respondents were asked to rate the effects of inaccurate cost estimation on the loss of reputation and credibility of project stakeholders where 1 = insignificant, 2 = little significance, 3 = fairly significant, 4 = significant, 5 = very significant, and U = unsure. Table 4 shows that 'loss of reputation and credibility for the contractor to be awarded another project for execution' had the highest ranking with a mean value (MV) =3.42. 'Loss of reputation and credibility for the quantity surveyor to gain a commission to manage another project' had the second highest ranking with MV=3.40. 'Loss of reputation and credibility for the project owner to implement new projects' had the third highest ranking with MV=3.39.

MacDonald (2011) determines the credibility, reputation and survival of project stakeholders, especially the forecaster, contractor's estimator and promoters, as the contributing agents for inaccurate cost estimation. It is apparent from the findings that inaccurate cost estimation jeopardises the chances of project stakeholders being awarded new projects.

Table 4: Effects on reputation and credibility of stakeholders

Loss of reputation and credibility	N	Mean Value	S.D	Rank
Contractor to be awarded another project for execution	74	3.42	1.26	1
Quantity surveyor to gain commission on another project	73	3.40	1.17	2
Project owner to implement new project	74	3.39	0.99	3
Project manager to gain commission on another project	74	3.22	0.99	4
Financing institution to finance another project	74	3.15	1.00	5
Architect to gain commission on another project	74	3.07	0.95	6
Civil engineer to gain commission on another project	74	3.01	0.98	7
Mechanical engineer to gain commission on another project	74	3.00	1.13	8
Electrical engineer to gain commission on another project	74	2.92	1.03	9
Structural engineer to gain commission on another project	74	2.89	1.02	10
Average mean value		3.14		

The average mean value (AMV) of 3.14 is between average to high of all the variables measured in terms of the loss of reputation and credibility of project stakeholders as effects of inaccurate cost estimate on construction projects. Mukuka et al. (2014) sum up the effects of cost underestimation on project stakeholder as ranging from financial loss, tarnished reputation, project abandonment and drop in building activities in the construction industry. Furthermore, Zainudeen, Kumari, and Seneviratne (2010) contend that cost underestimation brings about project abandonment, bad reputation and inability to secure project finance.

4.3.2 Exposure to risk

Respondents were asked to rate the significance of risk exposure as effects of inaccurate cost estimation on construction projects where 1 = insignificant, 2 = little significance, 3 = fairly significant, 4 = significant, 5 = very significant, and U = unsure. Table 5 shows that the risk of bankruptcy as a result of shortage of funds had the highest ranking with MV=3.78. The risk of delay in completion as a result of cash flow problems had the second highest ranking with MV=3.78. Finally the risk of an increase in claims due to an increase in the contract price had the third highest ranking with MV=3.73.

In addition to the findings on the effects of exposure to risk due to inaccurate cost estimation, Akintoye and MacLeod (1997) further contend that risk elements associated with construction projects have an influence on time, cost and quality. These risks associated with construction activities comprise environmental, design, logistic, financial, legal, political, construction and operational risks. Risks not adequately managed are perceived to adversely affect the successful completion of a project and consequently lead to loss on the side of the contractor.

Table 5: Risk exposure due to effects of inaccurate cost estimation

Exposure to risk	N	Mean Value	S.D	Rank
Risk of bankruptcy as a result of shortage of funds	74	3.78	0.74	1
Risk of delay in completion as a result of cash flow problems	74	3.78	0.83	2
Risk of increase in claims due to increase in contract price	74	3.73	0.66	3
Risk of project abandonment as a result of shortage of funds	74	3.66	0.68	4
Risk of litigation as a result of claims for additional payment	74	3.43	0.81	5
Risk of poor quality of work as a result of shortage of funds	74	3.35	1.18	6
Risk of physical damage due to poor workmanship	74	3.28	0.58	7
Average mean value		3.57		

The average mean value (AMV) of 3.57 is between average to high in all the variables measured in the exposure to risk of project stakeholders as effects of

inaccurate cost estimate on construction projects. Akintoye and MacLeod (1997) reveal that contractors perceive project risk as an adverse possibility which affects the successful completion of project in terms of cost, time and quality.

4.3.3 Financial loss

Respondents were asked to rate the significance of financial loss due to the effects of inaccurate cost estimation on construction projects where 1 = insignificant, 2 = little significance, 3 = fairly significant, 4 = significant, 5 = very significant, and U = unsure. Table 6 shown that loss of profit to contractors had the highest ranking with MV=3.88. The loss of resources of the project owner had the second highest ranking with MV=3.80, while loss of income to the financing institution had the third highest ranking with MV=3.55.

Akintoye (2000) emphasises that the loss incurred by contractors due to underestimated project cost in the construction industry is significantly low compared to other industries. However, project cost that is inaccurately estimated will have a negative effect on a contractor's profitability as well as that of other stakeholders.

Table 6: Financial loss on construction project due to effects of cost underestimation

Financial loss	N	Mean Value	S.D	Rank
Loss of profit to contractor	74	3.88	0.95	1
Loss of resource of project owner	74	3.80	0.84	2
Loss of income to financing institution	74	3.55	1.21	3
Negative effect on project end user	74	3.36	1.21	4
Misallocation of financial resources	73	3.22	1.05	5
Loss of income to mechanical engineer	74	3.09	1.13	6
Loss of income to quantity surveyor	74	3.07	1.10	7
Loss of income to structural engineer	74	3.07	1.11	8
Loss of income to electrical engineer	74	3.05	1.12	9
Loss of income to civil engineer	74	3.01	1.10	10
Loss of income to architect	74	3.00	1.07	11
Loss of work in construction industry	74	2.98	1.12	12
Average mean value		3.25		

The AMV of 3.25 is between average to high of all variables measured in the financial loss of project stakeholders as effects of inaccurate cost estimate on construction projects. In addition to the finding on loss of profit, Babalola and Adesanya (2007) suggest that an underestimated cost would lead to a situation where

a contractor incurs losses on the contract. Flyvbjerg et al. (2002) reveal that the misrepresentation of project cost will lead to the misallocation of resources which will result in losses to those financing the project.

4.3.4 Effects of inaccurate cost estimation

From the ranking of average mean values of subsets of the effects of inaccurate cost estimate on construction project stakeholders, Table 7 shows that risk exposure is the most significant effect of inaccurate cost estimation.

Table 7: Effects of inaccurate cost estimation

Effects of inaccurate cost estimation	Average Mean Value	Rank
Risk exposure due to effects of inaccurate cost estimation mechanisms on cost	3.57	1
Financial loss as effects of inaccurate cost estimation	3.25	2
Loss of reputation and credibility of project stakeholders	3.14	3

5. CONCLUSIONS AND RECOMMENDATIONS

The paper explored the consequences which emanate from the effects of inaccurate cost estimate. The findings revealed that inaccurate cost estimation adversely affects project stakeholders. The findings based on empirical data revealed that risk exposure is the most rated effect of inaccurate cost estimation which leads to bankruptcy, delay in completion, increase in claims, project abandonment, litigation, poor quality of work, and risk of physical damages. From the findings, financial loss to project stakeholders is another effect of inaccurate cost estimation which leads to a loss of profit to contractor, loss of resources of the project owner, loss of income to the financing institution, a negative effect on project end-users, misallocation of financial resources and loss of work for project stakeholders. In addition, loss of reputation and the credibility of project stakeholders, particularly leading to the non-award of new projects to professional team and contractors, and the lack of motivation on the part of financial institutions and client to implementation of new construction projects are additional consequences of inaccurate cost estimate. The effects of inaccurate cost estimation have detrimental consequences for the construction industry and bear damaging effects on construction project stakeholders.

The paper recommends that project stakeholders responsible for cost estimation should take adequate precautions in the process of estimating project cost, with particular attention being paid to factors that influence the accuracy of cost estimation. It is recommended that these findings will contribute as a policy

guide in the construction sector by improving the accuracy of project cost estimate, and assisting project stakeholders in identifying, planning, managing and mitigating negative risk associated with cost-significant items.

6. REFERENCES

Al-Hasan, M., Ross, A. & Kirkham, R. (2006). An investigation into current cost estimating practice of specialist trade contractors. In: *Proceedings of the 2006 Liverpool Built Environment & Natural Environment Conference,* London, UK: Liverpool John Moore University. Available online at: http://www.ljmu.ac.uk/BLT/BUE_Docs/alhassan.pdf.

Akintoye, A. (2000). Analysis of factors influencing project cost estimating practice. C*onstruction Management and Economics*, 18(1): 77-89.

Akintoye, A.S. & MacLeod, M.J. (1997). Risk analysis and management in construction. *International Journal of Project Management*, 15(1): 31-38.

Ashworth, A. & Skitmore, M. (1983). *Accuracy in estimating: The effectiveness of estimating in the construction industry.* The Chartered Institute of Building, Berkshire. Available online at: http://eprints.qut.edu.au/59703/ [Accessed 13 August 2014].

Azman, M.A. & Samad, Z.A. (2011). Perspective of quantity surveyor towards the accuracy of preliminary cost estimates in public of Malaysia. In: *Proceedings of the Quantity Surveying International Convention*, 11-12 October, Penang, Malaysia.

Babalola, O. & Adesanya, D.A. (2007). An evaluation of the level of accuracy of electrical services cost estimates in Nigeria In: Boyd, D. (Ed.*) Proceedings of the 23rd Annual Association of Researchers in Construction Management (ARCOM) Conference,* 3-5 September*,* Belfast, UK, pp.75-83.

Babbie, E. (2013). *The basics of social research* (6th ed.). California: Cengage Learning.

Cheung, F. K. T., Wong, M. W. L. & Skitmore, M. (2008). A study of clients' and estimators' tolerance towards estimating errors. *Construction Management and Economics,* 26(4): 342-362.

Danto Group. (2013). *The economic cycles*. Available online at: http://thedantoburksgroup.com/tag/economic-cycles/ [Accessed 24 January 2014].

Doloi, H. (2013). Cost overruns and failure in project management: Understanding the roles of key stakeholders in construction projects. *Journal of Construction Engineering and Management*, 139(3): 267-269.

European Commission. (1998). *Understanding and monitoring the cost-determining factors of infrastructure projects: A user's guide*. Available online at: http://ec.europa.eu/regional_policy/sources/docgener/evaluation/pdf/5_full_en.p

df. [Accessed 26 November 2013].
Flyvbjerg, B., Holm, M. S. & Buhl, S. (2002). Underestimating costs in public works projects: Error or lie? *Journal of the American Planning Association*, 68(3): 279-295.
George, D. & Mallery, P. (2003). *SPSS for Windows step by step: A simple guide and reference. 11.0 update* (4th ed.). Boston: Allyn & Bacon.
Gunner, J. & Skitmore, M. (1998). Building contract price forecasting: Price intensity theory. *Engineering, Construction and Architectural Management*, 6(3): 267-275.
Gupta, K.P. (2009). *Cost management: Measuring, monitoring and motivating performance.* New Delhi: Global India Publications.
Kothari, C. R. 2(004). *Research methodology: Methods and techniques* (2nd ed.). New Delhi: New Age International.
Kumar, C.R. (2008). *Research methodology*. New Delhi: APH Publishing.
Lakshmi, S. & Mohideen, M. A. (2012). Issues in reliability and validity of research. *International Journal of Management Research and Review,* 3(4): 2752-2758
MacDonald, R. (2011). Can cost overruns be avoided in capital works projects? If so, how? In: *Proceedings of the International Public Works Conference*, 21-24 August, Canberra, Australia.
Mahamid, I. & Dmaidi, N. (2013). Risks leading to cost overrun in building construction from consultants' perspective. *Organization, Technology & Management in Construction: An International Journal*, 5(2): 860-873.
Morrison, N. (1984). The accuracy of quantity surveyors' cost estimate. *Construction Management and Economics,* 2(1): 57-75.
Mukuka, M. J., Aigbavboa, C. O. & Thwala, W. D. A. (2014). Theoretical review of the causes and effects of construction projects' cost and schedule overruns. In: *Proceedings of the International Conference on Emerging Trends in Computer and Image Processing,* 15-16 December, Pattaya.
Nichols, M. (2007). *Review of highways agency's major programme*. London: Department for Transport (DfT). Available online at: http://assets.dft.gov.uk/publications/pgr-roads-nicholsreport/nicholsreport.pdf [Accessed 07 December 2013].
Nijkamp, P. & Ubbels, B. (1999). *How reliable are estimates of infrastructure costs? A comparative analysis.* Research Memorandum, Department of Spatial Economics, Free University Amsterdam. Available online at: http://degree.ubvu.vu.nl/RePEc/vua/wpaper/ pdf/19980029.pdf [Accessed 26 November 2013].
Olatunji, O.A. (2012). *The impact of building information modelling information modelling on estimating practice: Analysis of perspectives from four organizational business models*. The University of Newcastle's Digital Repository. Available online at:

http://novaprd.newcastle.edu.au/vital/access/manager/Repository/uon:12337.

Pickrell, D.H. (1990). *Urban rail transport project: Forecast versus actual ridership and cost report to office of grants management*. Urban Mass Transportation Administration, Washington, DC. Available online at: http://www.debunkingportland.com/docs/Pickrell(no_text).pdf [Accessed 27 November 2013].

Ponte, D.M. (2009). *Minimizing risks associated with construction cost estimates*. Available online at: http://asceinsurance.com/Portals/dnn.asceinsurance.com/forms/pl/articles/ASCE-PL-EstimateRisks-Article-F.pdf [Accessed 20 June 2014].

Project Management Institute. (1996). *A guide to the project management body of knowledge*. Pennsylvania: PMI Standards Committee.

Royal Institution of Chartered Surveyors (RICS). (2012). *New rules of measurement 2: Detailed measurement for building works.* Coventry]: RICS.

Skitmore, M. (1987). The effect of project information on the accuracy of building price forecasts. *Building Cost Modelling and Computers*, pp.327-336. Available online at: http://eprints.qut.edu.au/59693/1/15.pdf [Accessed 09 March 2015].

Skitmore, M. (1988). Factors affecting the accuracy of engineers' estimates. In: *Proceedings of the 10th International Cost Engineering Congress, the American Association of Cost Engineers,* 10-12 July, New York. Available online at: http://eprints.qut.edu.au/ 59700/ [Accessed 13 August 2014].

Skitmore, M. (1990). Which estimating technique? In: *Proceedings of the 11th International Cost Engineering Congress and 6th Association Francais des Ingenieurs et Techniciens D'estimation de Planification de Projets Annual Meeting*, 22-25 April, Paris. Available online at: http://eprints.qut.edu.au/9447/ [Accessed 13 August 2014].

Seeletse, S. & Ladzani, W. (2012). Project cost estimation techniques used by most emerging building contractors of South Africa. *Journal for the Physical and Development Sciences,* 19(1): 106-125.

Skitmore, M. & Wilcock, J. (1994). Estimating processes of smaller builders. *Construction Management and Economics*, 12(2): 139-154.

Skitmore, M., Stradling, S. & Tuohy, A. (1994). Human effects in early stage construction contract price forecasting. *Engineering Management,* 42(1): 29-40.

Stewart, R.D. (1991). *Cost estimating* (2nd ed.). New Jersey: John Wiley and Sons.

Skitmore, M. & Cheung, F. K. (2007). Explorations in specifying construction price forecast loss functions. *Construction Management and Economics*, 25(5): 449-465.

Zainudeen, M., Kumari, G. & Seneviratne, T. (2010). Impact of design changes on contractors' cash flow. *Built Environment Sri Lanka,* 8(1): 2-10. Available online at: http://doi.org/10.4038/besl.v8i1.1905 [Accessed 05 July 2016].

CONSTRUCTION PROFESSIONALS' PERCEPTION OF THE MARKETING STRATEGIES EMPLOYED BY CONSTRUCTION FIRMS IN ABUJA, NIGERIA

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ABSTRACT

Effective marketing plays an important role in the overall success of companies and it is critical for any business to grow in the competitive environment. However, construction firms are unyielding to the complete adoption of comprehensive and effective marketing strategies to improve their performance and position in competition within the construction industry. This study assessed the perception of construction professionals regarding the marketing strategies adopted by construction firms in Abuja, Nigeria. The study adopted a questionnaire survey approach and a random sampling method was used to administer the questionnaire to 415 construction professionals. The response rate was 45.3%, and frequency, percentile, relative importance index and the Kruskal-Wallis test were used to analyze the data collected. The study revealed that maintaining a strong pool of professionals to boost the company image, developing non-economic or social bonds with clients, including 'political' offers in bids, having a project signboard, developing a marketable name as well as equipment branding, claim aversion, and free design contribution are the specific marketing strategies employed by construction firms. The major marketing strategies for improving the performance of construction firms are third-party-based strategies, project performance-based strategies, and client-based strategies. The study concluded that there is no significant statistical difference in the perception of respondents regarding the marketing strategies used in their firms. The study

recommended that construction firms should ensure that there is continuous management support targeted towards improving their overall marketing strategies.

Keywords: Construction firms, Construction industry, Construction professionals, Marketing strategies, Nigeria

1. INTRODUCTION

The construction industry is a crucial part of any economy because of its size and the potential role it can play in the development efforts of the economy (Nisa et al., 2006; Nnadi et al. 2016). The construction industry is the driving force behind the socio-economic development of any nation; and the industry takes a huge amount of money, time and energy (Saidu & Shakantu, 2016a; Saidu & Shakantu, 2016b; Nnadi et al. 2016; Meshksar, 2012). Its contribution to the national economy is well represented through the construction value addition, investment, employment, trade balance and sectorial linkages; as such, its importance is recognised in all communities (Meshksar, 2012; Nnadi et al., 2016). Construction firms which operate in the construction industry must strive to survive as they cannot exist without competition. According to Dulaimi and Shan (2002), the construction industry in most countries exists in a competitive business environment driven by the lowest cost mentality. The dynamics of demand and supply influence and shape the activities and performance of every construction firm. Construction projects are usually awarded based on the lowest tender sum, as well as the commercial and technical capabilities of the construction firm. Therefore construction projects are procured through the competitive bidding process.

Marketing is practised all over the world and it is referred to as the activity of getting the company to sell goods or services to customers (Ojo, 2011). Ogbu (2017) defined marketing as "…the activity, set of institutions, and processes for creating, communicating, delivering, and exchanging offerings that have value for customers, clients, partners, and society at large". The importance of marketing for the survival of companies cannot be ignored (Arslan et al., 2009; Nnadi et al. 2016). Therefore effective marketing plays an important role in the overall success of companies and it is critical for any business to grow in the competitive environment (Polat & Donmez, 2010). Thus the main objective of marketing construction firms is to create a positioning strategy within the entire construction market.

It has been observed that marketing has attracted only scant attention among construction contractors and professionals (Nnadi et al., 2016). In the same vein, the Nigerian construction firms have been generally known to be lagging in the adoption of marketing strategies to improve their performance, despite increasing pressure from competitors (Ogbu, 2017). Furthermore, marketing has not been completely

embraced in the construction industry because the concept is yet to be totally understood by construction practitioners (Ogbu, 2015; Mahmood et al., 2017). This has impacted on their publicity and their ability to secure and maintain construction projects. As a result, construction firms have been criticized for their unwillingness to employ effective and efficient marketing strategies to boost opportunities to secure and maintain construction projects. Mahmood et al. (2017) are of the opinion that the neglect of marketing in construction is due to the difficulty in applying conventional marketing in the industry, accompanied by inadequate research on the nature of marketing, marketing theories and strategies tailored to construction work.

Studies exist on the concept of marketing in the construction industry. However, many studies show that construction firms are slow in adapting marketing principles and marketing is not integrated into the structure of the firms (Winter & Peerce, 2000; Bennett, 2005; Adegbile, 2008). Alwashi et al. (2017) assessed the use of marketing strategies in the Nigerian construction industry. The study was aimed at identifying the impact of marketing management on the construction industry in Nigeria with a view to ensuring an effective marketing system in the industry. The study that examines the views of construction professionals found out that maintaining a strong pool of professionals to boost a company image was the most widely used among the marketing management strategies.

Ogbu (2017) studied marketing strategies and the performance of indigenous construction firms in Nigeria. The study focused on the influence of marketing strategies on the performance levels of indigenous construction firms (ICFs) in South-South Nigeria. The study utilized data collected from CEOs and managers of ICFs and found that maintaining a pool of professionals to boost company image was most frequently employed among the identified marketing strategies, and that the groups of marketing strategies that influence the ICF level of performance are third-party-based, client-based, firm-based, and publicity-based strategies. Ogbu (2017) also reported that a significant difference exists in the frequency of use of the marketing strategies by the different firm groups.

Ganah et al. (2008) investigated marketing strategies in the construction industry and the challenges facing small and medium enterprises in the development of these strategies. The study found that there is a lack of understanding of construction marketing and strategies within small and medium enterprises in the construction industry. The study also found that a strategy for marketing is non-existent in most instances (Ashworth & Hogg, 2007). Other studies have focused on marketing quantity surveyors' professional services or other professions in the built environment. Nnadi et al. (2016) evaluated the marketing practice of quantity surveying in South-Eastern Nigeria. Ogbu (2015) carried out a study on the application of marketing strategies in Nigerian quantity surveying firms.

Therefore, evidence in literature has shown that studies comparing the views of construction professionals regarding marketing strategies adopted by construction

firms, especially in the geographical area of this study, are non-existent. Thus, this study assessed the perception of construction professionals regarding the marketing strategies adopted by construction firms in Nigeria with a view to recommending strategies that will improve their publicity and ensure that they remain in the competition. The specific objectives of the study are to assess the marketing strategies employed by construction firms, and to identify the major marketing strategies employed by construction firms. The hypothesis that guided this study states that there is no statistically significant difference in the perception of construction professionals regarding the marketing strategies adopted by construction firms.

The outcome of this study would add to the body of knowledge available on construction marketing and management literature. The outcome of this will also assist construction managers in making decisions regarding the adoption of the most value-adding and suitable marketing strategy in line with a company's culture, and with respect to prevailing economic conditions. The twenty-first century construction companies and firms need to implement and maintain attainable marketing strategies if they must survive competition within the construction industry that is already flooded with foreign construction companies.

2. MARKETING IN THE CONSTRUCTION INDUSTRY

Marketing is critical to the survival of businesses, firms, and individuals as it offers opportunities for employment (Olaniyi et al., 2011) and impacts on the standard of living of individuals. It has been accepted that marketing ability influences financial success (Ode, 2007; Kotler & Keller, 2009), thus financial flows and business success are dependent on the choice and implementation of suitable marketing strategies. According to Ojo (2011), marketing is important for the existence and survival of companies. Therefore, the overall success of companies and the ability of any business to grow in the competitive environment are dependent on the effective marketing of firms' services (Polat & Donmez, 2010). Marketing, according to Olaniyi (2014), is the function that links the consumer, customer, and public in identifying and defining marketing opportunities and problems; generating, refining, and evaluating marketing actions; monitoring marketing performance, and improving an understanding of marketing as a process.

The construction industry, like any other sector of the economy, faces keen competition for survival and sustenance. Despite the existence of many studies on the concept of marketing in the construction industry (Ojo, 2011), the concept has not been fully embraced by construction firms. Ojo (2011) concurs that many construction professionals face difficulties in selling their services owing to failure to embrace the marketing concept. For instance, Morgan (1990) confirmed that only a few engineering service consulting firms had a marketing department.

Similarly, in his study of marketing practices among Nigerian construction firms Adegbile (2008) concluded that there was little or no marketing in the Nigerian construction industry. The majority of the contractors, according to Dikmen et al. (2005), do not regard the marketing capability as a strategic success factor. Also, Ganah et al. (2008) asserted that the majority of construction firms are yet to adopt marketing as the cornerstone of strategy and management. This was supported by Jaafar et al. (2008), whose report showed that in Malaysia many civil and structural consultancy firms had neither marketing departments nor employees specifically responsible for marketing.

According to Polat and Donmez (2010), Turkish contractors made use of marketing management functions to some extent. This may be attributed to the lack of understanding of marketing principles within small to medium enterprises (Ganah et al., 2008). It is important to state that small and medium construction firms dominate the construction space of the construction sectors of many countries. Company image and customer satisfaction are vital factors for successful marketing in the construction business (Arslan et al., 2009). Therefore, Adegbile (2008) suggested the need for awareness of the importance of marketing as a tool to withstand the fierce competition in the Nigerian construction business environment. Also, Yisa et al. (1996) proposed a framework for improving the effectiveness of the marketing function within construction enterprises. Yisa et al. (1996) suggested that a practical approach for formulating, implementing and evaluating corporate marketing programmes could be represented in the framework.

2.1 Marketing strategies in construction

A strategy is a general plan or set of plans designed to achieve a targeted goal over a long period of time (Olaniyi, 2014). According to Akpan (2003), at the most macro level, marketing strategies focus on manipulations of the marketing mix variables; they involve picking a target market and selecting a marketing mix to serve that market. According to Ojo (2011), a marketing strategy is a managerial process of analysing market opportunities and choosing a marketing position that serves the company's purpose and objectives. It is the company's response to the external environment and consists of a set of principles by means of which a company hopes to achieve its long-term customer and profit objectives in a competitive environment. Marketing strategies are the means by which professional firms sell their services to their intending clients. They play an important role in the success of a construction company in this highly competitive industry (Ojo, 2011).

Lee et al. (2008) identified the marketing strategies of Korea's housing construction firms and classified them as green, well-being and ubiquitous. Zeithaml et al. (1985) suggested various strategies for problems stemming from unique service features. These include creating a strong organisation image, using cost accounting to help set prices, engaging in post-purchase communication, managing consumers, and

using multisite locations, among others. Alwashi et al. (2017) identified 28 marketing strategies adopted by construction firms, and grouped them into six major headings, namely the location of the firm, professional client relationship, professional contract, price and other user strategies, business promotion and education strategy, and research as a marketing strategy. Alwashi et al. (2017) found that maintaining a strong pool of professionals to boost a company's image, packaging a company's documents to look attractive, outsourcing supervision to more competent professionals, writing of proposals, and maintaining a cordial relationship between client and other professionals as well as staff competence, site architecture, competition, and navigation audit were the highest-ranking marketing strategies used by construction professionals. Alwashi et al. (2017) concluded that offering seasonal gifts to the client, the use of Internet-based advertising, being listed in the business directory, and offering branded notepads, pens, and other items to the client are least practised strategies in the construction industry. However, irrespective of the level of adoption by professionals, they should be encouraged to improve performance.

Ogbu (2017) identified 43 marketing strategies used by indigenous construction firms and grouped them into five major strategies. They are third-party-based strategies, client-based strategies, publicity-based strategies, firm-based strategies, and project performance-based strategies. Ogbu (2017) reported that maintaining a strong pool of professionals to boost the company image, the use of project signboards and the development of non-economic or social bonds are the three most frequently used marketing strategies; the least used marketing strategy was the location of the firm close to the client. Also, the groups of marketing strategies that influence indigenous construction firms' level of performance are third-party-based, client-based, firm-based, and publicity-based strategies. This study adopted the marketing strategies identified from Ogbu (2017) and Alwasi et al. (2017).

Marketing strategies are centred on a competitive marketing strategy, the internal and external business environment in which the firm operates, and a relationship marketing strategy. Available studies on marketing strategies in construction mostly focus on firms and professionals. While there are very few existing studies that compare the views of construction professionals on marketing strategies in Nigeria, there are no studies that have assessed the perception of construction professionals of marketing strategies used in the construction industry within the study area of this study. This study critically examined the relative views of construction professionals of the marketing strategies adopted by the construction firms in which they found themselves.

3. RESEARCH METHODOLOGY

The study covered the assessment of the perception of construction professionals regarding the marketing strategies adopted by construction firms in Abuja, Nigeria.

Abuja was chosen for the study based on the premise that Abuja is the administrative headquarters of the country with many construction firms having their head office or branches in the country's capital (Aje et al., 2015). In addition, there are many construction projects being executed on a daily basis. Furthermore, most of the professional bodies related to construction works have either their head office or liaison office in Abuja. According to Saidu and Shakantu (2016c), Abuja is one of the metropolitan cities in Nigeria with the highest population of construction professionals practising in either constructing or consulting firms within the built environment.

A quantitative research approach was adopted for the study, and structured questionnaires were used to collect data on the perception of the various professionals regarding the marketing strategies adopted by construction firms in Nigeria. The questionnaires were administered by the researchers and through the help of trained field assistants who were properly briefed about the research topic and given the necessary information on how to administer the questionnaire. The questionnaire was designed in two sections using information derived from the review of the related literature. The section labelled 'A' covered the general information of the target respondents. Information gathered from the section labelled 'A' served as a quality check and verification of the data from the other part of the questionnaire. The section labelled 'B' covered the views of the professionals on the marketing strategies adopted by their firms. A total of 43 marketing strategies identified from Ogbu (2015), Ogbu (2017) and Alwashi et al. (2017) were adopted for this study. Respondents were requested to rate these strategies base on the level of efficacy in improving the public image of the company and on their ability to secure new jobs and maintain relationships with parties on existing projects. This was based on a five-point Likert scale, where 1 = very ineffective, 2 = ineffective, 3 = average, 4 = effective, 5 = very effective.

A pilot survey was adopted to test the suitability and appropriateness of the questionnaire in meeting the study objectives as suggested by Fellows and Liu (2008). Twenty (20) of the draft questionnaires were randomly distributed to the selected construction professionals and academics, and the final draft was adjusted based on their feedback. A total of 415 questionnaires were randomly distributed to construction professionals within the study area. A total of 188 of the questionnaires were retrieved out of the 415 distributed, representing a 45.3% response rate, and were deemed fit for the analysis. This response rate is above the usual response rate of 20-30% for questionnaire surveys in construction management studies as suggested by Akintoye (2000). Furthermore, the reliability and internal consistency of the questionnaire was carried out using Cronbach's alpha test. This test measured the reliability of each of the fields of the questionnaire and the mean of all the fields of the same questionnaire. The acceptable value range of Cronbach's alpha is between 0.0 and +1.0 and the more the value tends toward 1, the higher the degree of

internal consistency is. The Cronbach's alpha value for the variables is 0.825, thereby implying that the questionnaire is credible and has a high degree of reliability. According to Moser and Kalton (1999), a research instrument is perfect if the value of the Cronbach's alpha tends towards 1.0.

Frequencies, percentages, and the relative importance index (RII) were used to analyse the collected data. Frequencies and percentages were used to analyse the general information of the respondents; RII was used to assess the views of the respondents regarding the marketing strategies adopted by their firms, and the Kruskal-Wallis test was performed to determine the relationship in the view of the respondents regarding the variables, and to test the hypothesis. The rule for accepting or rejecting the hypothesis is accept the hypothesis if the P-value ≥ 0.05, and reject the hypothesis if the P-value <0.05. These analyses were carried out using the Statistical Package for Social Science (SPSS) Version 20.

4. RESULTS AND DISCUSSION

The analysis of the respondents' characteristics showed that in terms of their designation in their organization project 37.23% are project managers, 20.74%, and 9.57% are contract managers or administrators and quality and safety managers respectively, 2.13% are project directors and 30.32% of them are project team members. Moreover, 48.40% of the respondents have between one and ten years of experience, 39.89% have 11-20 years, 9.04% and 2.66% of them have 21-30 years and 31-40 years' experience respectively, while none has more than 40 years of experience. Most of the participants hold a bachelor of science or a bachelor of technology degree (46.28%). This was followed by those with a higher national diploma (29.79%) and then a master of science or a master of technology degree (21.81%), and lastly, doctorates number 2.13%. This implies that the respondents are experienced and academically qualified to give reliable information in a construction-based study.

In addition, according to the respondents, 76.6% are always involved in marketing the services of their firm, 23.94% of them sometimes do marketing, and 3.72% of them have never been involved in marketing. This implies that the respondents are aware of the role marketing plays in construction firms. The analysis also revealed that 32.45% (61) of the respondents are registered quantity surveyors with the Nigerian Institute of Quantity Surveyors (NIQS). A total of 27.13% (51) are engineers (civil and services) registered with the Nigerian Society of Engineers (NSE), and 23.40% (44) are architects registered with the Nigerian Institute of Architects (NIA). In addition, 17.02% (32) of the respondents are builders registered with the Nigerian Institute of Building (NIOB). The rationale behind the high proportion of quantity surveyors is that they have been enlightened on matters associated with marketing their professional services and the services of their

employers which are most times construction and consulting firms. Evidence of the professional membership of the respondents shows that they are professionally qualified to give expert opinions on the subject of this study.

Table 1 shows the result of the analysis of the construction professionals' perception of the marketing strategies practised in their firms. From Table 1 and under the third-party-based strategies, the builders and engineers are of the opinion that maintaining a strong pool of professionals to boost the company image (RII = 0.975) and (RII = 0.969) and conflict management (RII = 0.913) and (RII = 0.953) respectively were best among the sub-group. The quantity surveyors are of the opinion that the most important marketing strategies are conflict management (RII = 0.938) and maintaining a strong pool of professionals to boost the company image (RII = 0.836), whereas the architects are of the opinion that maintaining a strong pool of professionals to boost company image (RII = 0.959) and outsourcing project supervision to more well-known external personnel (RII = 0.936) are the most effective strategies among the sub-group.

Overall, the most important and effective marketing strategies adopted by construction firms are maintaining a strong pool of professionals to boost the company image and conflict management. This finding is in agreement with the findings of Ojo (2011), Alwashi et al. (2017) and Ogbu (2017). Ogbu (2017) reported that highest among the most frequently used marketing strategies by indigenous construction firms is the ability of the firms to maintain a strong pool of professionals to boost the company image (with a mean = 3.79) and Alwashi et al. (2017) ranked maintaining a strong pool of professionals to boost the company image first with RII = 0.93. This strategy is therefore critical to the survival and existence of any construction firm.

Similarly, under the client-based strategies, the builders rated ‘more communication with clients' first, the quantity surveyors ranked it third, the architects ranked it second, and the engineers are of the opinion that it should be ranked fifth. There seems to be agreement among the respondents regarding ‘inclusion of "political" offers in bids'. This strategy was ranked second by the builders, quantity surveyors, and engineers, but was ranked third by the architects. Also, ‘development of non-economic or social bonds with clients' was ranked first by the quantity surveyors, architects and engineers, but ranked third by the builders. Also, the builders, quantity surveyors and architects ranked ‘project co-development strategy / public-private partnership’ fourth, but this was ranked third by the engineers. ‘Ensuring client feedback' was ranked fifth by the builders, quantity surveyors and architects, but was ranked fourth by the engineers. Overall, the development of non-economic or social bonds with clients, inclusion of ‘political’ offers in bids, more communication with clients, project co-development strategy or public-private partnership, and ensuring client feedback were ranked first, second, third , fourth and fifth respectively. This finding corroborates the reports of Ogbu

(2017), Alwashi et al. (2017) and Ojo (2011). Ogbu (2017) reported that the development of non-economic or social bonds with clients (mean = 3.63), project co-development strategy or public-private partnerships (mean = 3.62) and the inclusion of 'political' offers in bids (mean = 3.62) are the most frequently used marketing strategies under the client-based strategies. According to Ogbu (2017), client-based marketing strategies are mainly focused on directly improving firm performance. The establishment of social bonds with potential and existing clients, more communication and a feedback system will enhance client trust and could lead to repeat business.

For the publicity-based strategies, a project signboard was ranked first by all the professionals. Equipment branding was ranked second by the builders, architects, and engineers, but was ranked fourth by the quantity surveyors. Packaging company documents to look attractive was ranked third by all the professionals. Writing of proposals was ranked fourth by the builders and architects, but was ranked fifth by the quantity surveyors and engineers. The company website was ranked fifth by the builders and architects but was ranked second by the quantity surveyors and fourth by the engineers. Overall, project signboards, equipment branding, packaging company documents to look attractive, company websites, and writing of proposals were ranked first, second, third, fourth and fifth respectively. This finding supports the reports of Ogbu (2017) and Alwashi et al. (2017). Ogbu (2017) reported that project signboards (mean = 3.76) and packaging company documents to look attractive (mean = 3.46) are the most frequently used among the publicity-based strategies. Alwashi et al. (2017) report ranked packaging companies' document to look attractive in the second position with (RII = 0.91) and written proposals were ranked fifth (RII = 0.84). Publicity plays a major role in improving a firm's performance. This is because if what is being produced or the services being rendered are not marketed, they cannot be patronized. In addition, a well-packaged company document will always look catching and appealing. This will improve a company's public image.

For the firm-based strategies, the builders ranked the development of a marketable name as first, the use of promotional products and claim aversion occupied the second place ranking, market segmentation and product differentiation were ranked fourth, and use of information and communication technology (ICT) in service delivery ranked fifth. The quantity surveyors, architects and engineers ranked claim aversion as first; the development of a marketable name was ranked second by both the quantity surveyors and the engineers, but was ranked third by the architects. The quantity surveyors ranked market segmentation and product differentiation third; the use of information and communication technology (ICT) in service delivery was ranked second by the architects, and the use of promotional products was ranked second by the engineers. Overall, claim aversion, the development of a marketable name, market segmentation and product differentiation, the use of promotional

products, and the use of information and communication technology (ICT) in service delivery were ranked first, second, third, fourth and fifth respectively. This finding agrees with the findings by Ogbu (2017) who reported that claim aversion (mean = 3.35) and the development of a marketable name (mean = 3.34) are the most frequently used among the firm-based strategies. Adequate control and monitoring of projects by construction firms should be ensured to avoid unnecessary claims arising. This will avoid claims that could even lead to legal tussles. Firms should develop a name that could be marketed to the public and ensure that buildings are properly finished on time, within budget, and meet the specific client requirements.

Information and communication technology (ICT) generally covers the harnessing of electronic technology for the information needs of a business at all levels. It refers to the automation of processes, controls, and information production using computers, and telecommunication software (Emmanuel & Adebayo, 2011). ICT in construction entails the use of computer systems that are capable of capturing, organizing, storing, analysing, exchanging, transmitting, and sharing information (Perkinson & Ahmad, 2006).

Nowadays, many ICT products are progressively being used in the marketing of construction firms and professional services owing to the sophistication of construction clients. For instance, the use of the Internet via a personal computer (PC) and mobile phones, email marketing, websites, social media (Facebook, LinkedIn, Twitter, Whatsapp, among others), and telephone marketing have changed the face of marketing in the construction industry. The Internet serves as an important medium for reaching a wider spectrum of individual contractors and suppliers, construction and consultant firms and organisations. Internet marketing involves the use of the Internet for the marketing of construction firms' products or services, utilising either the Internet or traditional channels (Bengtsson et al., 2007). Email marketing involves the use of emails in marketing; it entails the sending of direct promotional emails to secure new clients or persuade existing clients to patronise again (Alexander, 2009).

Construction companies and construction professionals have to capitalise on the revolution in Internet marketing through social media to market their products and services. This has positively affected the revenue and productivity of construction firms. Ibironke et al. (2011) observed that there is increasing awareness of the importance of information technology in improving service delivery and productivity among construction professionals

Under the project performance-based strategies, improvement in project performance and free design contribution were ranked first and second respectively by the builders. The quantity surveyors, architects and engineers ranked free design contribution first, and improvement in project performance was ranked second by the quantity surveyors and engineers. A free maintenance service offer was ranked second by the architects. Overall, free design contribution and improvement in

project performance were ranked first and second respectively. This finding is in line with that of Ogbu (2017) who reported that free design contribution (mean = 3.52) and improvement in project performance (mean = 3.30) are the most frequently used among the project performance-based strategies used by indigenous contractors. Construction firms should at no extra cost to the client do free designs as a way of contributing to the progress of the building under construction. This will ensure speedy construction and that the client will be relieved of the financial burden.

Table 1: Construction professionals' perception of marketing strategies

		Bldr.		Q. S		Arch.		Engr.		Overall	
S/N	Factors	RII	Rk	RII	Rk	RII	Rk	RII	Rk	RII	Rk
	Third Party-Based Strategies										
1	Outsourcing project supervision to more well-known external personnel	0.438	4	0.354	5	0.936	2	0.827	4	0.64	4
2	Investments in networking with other firms	0.888	3	0.718	3	0.9	3	0.929	3	0.86	3
3	Conflict management	0.913	2	0.938	1	0.895	4	0.953	2	0.92	2
4	Maintaining a strong pool of professionals to boost company image	0.975	1	0.836	2	0.959	1	0.969	1	0.93	1
5	Corporate social responsibility/ sponsorships of events in your area of operation	0.263	5	0.679	4	0.791	5	0.812	5	0.64	5
	Client-Based Strategies										
1	Financial and non-financial rewards for staff	0.838	6	0.646	7	0.664	10	0.859	6	0.75	7
2	Relational marketing	0.756	8	0.548	10	0.832	6	0.847	7	0.75	8
3	Granting of credit/flexible payment options	0.756	8	0.672	6	0.832	6	0.847	7	0.78	6
4	Offering seasonal gifts to clients	0.313	12	0.485	11	0.327	12	0.475	11	0.4	11
5	Development of non-economic or social bonds with clients	0.944	3	0.98	1	0.991	1	0.965	1	0.97	1
6	Project co-development strategy/ public-private partnership	0.913	4	0.925	4	0.923	4	0.937	3	0.92	4
7	Inclusion of 'political' offers in bids	0.975	2	0.948	2	0.932	3	0.945	2	0.95	2
8	Offering branded notepads, pens and other items to clients	0.794	7	0.607	8	0.768	8	0.769	9	0.73	9
9	Ensuring client feedback	0.906	5	0.918	5	0.864	5	0.898	4	0.9	5
10	More communication with clients	0.988	1	0.928	3	0.936	2	0.894	5	0.94	3
11	Customisation of projects to suit clients	0.694	10	0.574	9	0.695	9	0.706	10	0.67	10
12	Location of firm closer to clients	0.338	11	0.348	12	0.35	11	0.294	12	0.33	12
	Publicity-Based Strategies										
1	Packaging company documents to look attractive	0.906	3	0.869	3	0.905	3	0.973	3	0.91	3

2	Affinity marketing (combined marketing with firms offering complementary projects or products)	0.438	9	0.328	10	0.477	8	0.471	9	0.43	9
3	Use of Internet-based advertisements	0.469	8	0.656	6	0.332	9	0.522	8	0.49	8
4	Being listed in business directories (Yellow Pages)	0.656	7	0.63	7	0.605	6	0.714	6	0.65	6
5	Writing of proposals	0.881	4	0.662	5	0.855	4	0.914	5	0.83	5
6	Project signboard	0.963	1	0.98	1	0.977	1	0.992	1	0.98	1
7	Company websites	0.794	5	0.941	2	0.755	5	0.961	4	0.86	4
8	Use of print media advertisements	0.713	6	0.469	9	0.582	7	0.667	7	0.61	7
9	Equipment branding	0.956	2	0.852	4	0.95	2	0.976	2	0.93	2
10	Broadcast media	0.269	10	0.564	8	0.305	10	0.231	10	0.34	10
	Firm-Based Strategies										
1	Development of a marketable name	0.9	1	0.934	2	0.914	3	0.773	2	0.88	2
2	Transactional marketing	0.35	11	0.734	5	0.482	9	0.624	11	0.55	10
3	Environmental scanning/research	0.825	6	0.689	9	0.65	8	0.667	7	0.71	7
4	Market segmentation/product differentiation	0.844	4	0.918	3	0.877	4	0.757	4	0.85	3
5	Use of promotional products	0.881	2	0.823	4	0.795	6	0.773	2	0.82	4
6	Use of information and communication technology (ICT) in service delivery	0.831	5	0.705	6	0.918	2	0.686	6	0.79	5
7	Acquisition of personnel and equipment	0.806	7	0.702	7	0.868	5	0.667	7	0.76	6
8	Registration with client bodies	0.519	10	0.692	8	0.427	10	0.757	4	0.6	9
9	Claim aversion	0.881	2	0.961	1	0.955	1	0.847	1	0.91	1
10	Corporate social responsibility/charitable initiatives	0.719	8	0.682	10	0.7	7	0.667	7	0.69	8
11	Marketing plan	0.638	9	0.407	11	0.35	11	0.627	10	0.51	11
	Project Performance-Based Strategies										
1	Improvement in project performance	0.925	1	0.925	2	0.773	3	0.847	2	0.87	2
2	Free maintenance service offer	0.594	4	0.813	4	0.85	2	0.667	5	0.73	3
3	Selling the benefits not the features	0.625	3	0.869	3	0.65	5	0.757	4	0.73	4
4	Supply chain management	0.344	5	0.793	5	0.755	4	0.796	3	0.67	5
5	Free design contribution	0.781	2	0.928	1	0.932	1	0.969	1	0.9	1

Bldr. = Builders; Q.S = Quantity surveyors; Arch. = Architects; Engr. = Engineers; Rk = Rank

Based on the average ranking of the major grouping of the marketing strategies in Table 2, the builders ranked client-based strategies and firm-based strategies as first and second respectively. The quantity surveyors ranked project performance-based strategies and firm-based strategies in the first and second positions respectively. Similarly, the architects and engineers ranked third party-based strategies and project performance-based strategies first and second respectively. On overall, third-party-based strategies, project performance-based strategies and client-based strategies are the most vital marketing strategies for the improved performance of construction firms. This is in agreement with Ogbu (2017), who suggested that areas of emphasis when selecting a marketing strategy to adopt

are a third party-based strategy, client-based strategy, firm-based strategy and publicity-based strategy.

The relative difference in the opinion of the different professionals is an indication of the existence of differing marketing strategies adopted by the different organisations. This is relevant in marketing as it reveals why some firms are constantly being commissioned for new jobs and others rarely secure jobs in a given business year. The success of a chosen set of marketing strategies is dependent on the effective implementation and commitment from top management and a company's strategic marketing policy. The organisational type and strategic objective to a very large extent influence the choice when adopting marketing strategies. Thus, a construction-based firm will certainly adopt a different marketing approach when compared to a consultant firm. Regardless of the differences, marketing strategies are targeted towards attracting potential clients and securing new or maintaining existing projects. For adaptive marketing strategies to be developed, it is necessary to have an adequate knowledge and understanding of the business environment of the organisation as opined by Bamber et al. (2004) and Yan and Chew (2011).

Table 2: Average ranking of marketing strategies based on major sub-group

S/N	Marketing strategies	Bldr.		Q. S		Arch.		Engr.		Overall	
		RII	Rk	RII	Rk	RII	Rk	RII	Rk	RII	Rk
1	Third party-based strategies	0.695	4	0.705	4	0.896	1	0.898	1	0.799	1
2	Client-based strategies	0.768	1	0.715	3	0.759	3	0.786	3	0.757	3
3	Publicity-based strategies	0.704	3	0.695	5	0.674	5	0.742	4	0.704	5
4	Firm-based strategies	0.745	2	0.750	2	0.721	4	0.713	5	0.732	4
5	Project performance-based strategies	0.654	5	0.866	1	0.792	2	0.807	2	0.780	2

Table 3 shows the Kruskal-Wallis test carried out at 95% confidence level. The test showed that there is no significant difference in the ranking of the marketing strategies used in the construction firms. There seem to be consistencies in the perception of the various professionals regarding the variables. In all the major groupings of the marketing strategies, the test shows that there is no significant difference in the ranking as perceived by the respondents. These strategies recorded a significant p-value of above 0.05. Since 100% of the strategies are effective for improving performance and helping firms maintain and secure projects when implemented, it was then concluded that there is agreement among the respondents regarding the strategies in the construction industry. This was supported by a further analysis in Table 4 using the RII of each group for all the strategies: this showed a P-value of 0.895. Based on this, the hypothesis was therefore accepted.

Table 3: Comparison of professionals' perception regarding the marketing strategies of construction firms

S/N	Marketing Strategies	Overall Average		Kruskal-Wallis				
		RII	Rank	Respondents	Mean Rank	Chi Sq.	P-value	Decision
1	Third party-based strategies	0.7986	1	Bldr.	9.40	3.137	0.371	Accept
				Q. S	7.20			
				Arch.	12.40			
				Engr.	13.00			
2	Client-based strategies	0.7571	3	Bldr.	25.25	0.562	0.905	Accept
				Q. S	22.08			
				Arch.	24.50			
				Engr.	26.17			
3	Publicity-based strategies	0.7039	5	Bldr.	19.90	1.093	0.779	Accept
				Q. S	19.30			
				Arch.	19.00			
				Engr.	23.80			
4	Firm-based strategies	0.7323	4	Bldr.	24.50	1.922	0.589	Accept
				Q. S	24.23			
				Arch.	23.36			
				Engr.	17.91			
5	Project performance-based strategies	0.7796	2	Bldr.	6.30	4.669	0.198	Accept
				Q. S	14.30			
				Arch.	10.20			
				Engr.	11.20			

N = 32 for Building, N = 61 for Quantity Surveyor, N = 44 for Architect, N = 51 for Engineering, df = 3

Table 4: Overall comparison of professionals' perception of marketing strategies of construction firms

Marketing Strategies	Kruskal-Wallis				
	Respondents	Mean Rank	Chi Sq.	P-value	Decision
Marketing Strategies	Bldr.	88.45	0.608	0.895	Accept
	Q. S	83.08			
	Arch.	90.36			
	Engr.	85.81			

N = 32 for Building, N = 61 for Quantity Surveyor, N = 44 for Architect, N = 51 for Engineering, df = 3

In order to confirm the observation of the Kruskal-Wallis test, the Mann-Whitney U-test was conducted to test for differences between two independent groups where the overall Kruskal-Wallis test is significant. According to Boduszek (2017), if the overall K-W test is significant, the Mann-Whitney tests should be conducted to compare the groups (to investigate which groups differ significantly). In all the pairs, the p-value is greater than 0.05 at 95% confidence level (Table 5). This observation leads to the conclusion that there is no significant difference among the perceptions of the respondents and between any pairs of the respondents.

Table 5: Result of Mann-Whitney U-test

Variable group	Z (calculated)	Z (critical)	P-value	Decision
Builders vs Quantity surveyors	-0.441	8	0.659	Accept
Builders vs Architects	-0.147	7	0.883	Accept
Builders vs Engineers	-0.276	8	0.782	Accept
Quantity surveyors vs Architects	-0.714	9	0.475	Accept
Quantity surveyors vs Engineers	-0.335	9	0.738	Accept
Architects vs Engineers	-0.454	8	0.650	Accept

N = number of respondents in each group; Bldr. = 32, Q.S = 61, Arch. = 44, Engr. = 51

5. CONCLUSION AND RECOMMENDATIONS

Construction firms and construction professionals are yet to fully appreciate and implement marketing strategies that could impact positively on their performance and drive revenue generation. The study adopted a random sampling technique in collecting data on the perception of construction professionals on the marketing strategies used by their firms. The outcome of this study would assist the industry's decision makers in making informed decisions regarding the most beneficial marketing strategies to implement. This study assessed the perception of construction professionals regarding the marketing strategies adopted by construction firms in Nigeria with a view to recommending strategies that will improve their publicity and ensure that they remain competitive.

The study revealed that maintaining a strong pool of professionals to boost the company image, the development of non-economic or social bonds with clients, the inclusion of 'political' offers in bids, more communication with clients, project signboards, equipment branding, packaging company documents to look attractive, claim aversion, development of a marketable name, market segmentation and product differentiation, and free design contribution are the specific marketing strategies employed by construction firms. In addition, the major marketing strategies for the improved performance of construction firms are third-party-based strategies, project performance-based strategies and client-based strategies. The study concluded that there is no significant statistical difference in the perception of the

respondents regarding the marketing strategies used in their firms or organizations.

Based on the findings and conclusion, the study made the following recommendations:

1) Construction firms should ensure that they always maintain the use of a strong pool of professionals to boost company image. This is critical to the success and performance improvement of any firm.
2) Construction companies should develop social or non-economical and political relationships with their clients, with strong and regular communications links. This will surely lead to trust and more or repeat patronage.
3) Construction firms must ensure that they erect project signboards on every site which will display to potential clients their name and project type, among other information. In addition, all their equipment should be branded and every company document should be neatly packaged so that they are appealing to the eye.
4) Construction firms should ensure adequate control to avoid unnecessary claims arising during construction. They should ensure that they develop a name that could be marketed to the public and that buildings are properly finished on time, within budget, and meeting the specific client requirements.
5) Construction firms should at their own cost do free designs as a way of contributing to the progress of the building under construction. This will ensure speedy construction and that the client is relieved of the financial burden.

Construction firms should ensure that there is continuous management support targeted towards improving their overall marketing performance. Studies that have completely exhausted the list of marketing strategies available either in corporate organisations or to be found among the marketing management functions of firms are still lacking. Therefore, a further study regarding construction professionals' perception of the marketing strategies employed by construction firms could be carried out, adopting other region or zone in Nigeria. This would enable more marketing strategies to be identified through interviewing, brainstorming or brainwriting, among others, in addition to the use of questionnaires. A study that would examine what triggers the adoption of certain marketing strategies should be embarked upon.

6. REFERENCES

Adegbile, M. (2008). Prominence of marketing among firms. *Journal of Quantity Surveyors*, 55(1): 6 –10.

Aje, I. O., Makanjuola, S. A. & Olatunji, O. A (2015). Assessment of factors affecting bid-no-bid decision of construction contractors in Nigeria. In:

Ogunsemi, D. R., Awodele, O. A. & Oke, A. E. (Eds). *Proceedings of the 2nd Nigerian Institute of Quantity Surveyors Research Conference,* Federal University of Technology, Akure, pp. 529-536.

Akintoye, A. (2000). Analysis of factors influencing project cost estimating practice. *Construction Management and Economics*, 18: 77-89.

Akpan, A. B. (2003). *Marketing strategy concept and application* (2nd ed.) Zaria: Dada Press.

Alexander, O.O. (2009). *ICT in Marketing - A study of the use of internet and mobile phones in five selected companies in Dublin*. Master's thesis submitted to Blekinge Institute of Technology, Dublin, pp. 1-84.

Alwashi, J. D., Chitumu, D.Z. & Bobai, I. A. (2017). An assessment on the use of marketing strategies in the Nigerian construction industry: A case study of North West and North Central Nigeria. *Paper presented at the 27th Biennial conference of the Nigerian Institute of Quantity Surveyors*, Kado, Abuja.

Arslan, G., Kivrak, S. & Tankisi, M. (2009). Factors affecting marketing success for construction companies in the housing sector. In: *Proceedings of the Fifth International Conference on Construction in the 21st Century (CITC-V), Collaboration and Integration in Engineering, Management and Technology*, 20-22 May, Istanbul, Turkey.

Ashworth, A. & Hogg, K. (2002). *Willis's practice and procedure for the quantity surveyor* (11th ed.). Oxford: Blackwell Science.

Bamber, G. J., Lansbury, R.D. & Wailes, N. (2004). Introduction. In: Bamber, G. J., Lansbury, R. D. & Wailes, N. (Eds.). *International and comparative employment relations: Globalisation and the developed market economies.* Sydney: Allen and Unwin.

Bengtsson, M., Hakan, B. & Vladimir, V. (2007). Integrating the internet and marketing operations: A study of antecedents in firms of different size. *International Small Business Journal,* 25(1): 27– 48.

Bennett, R. (2005). Marketing policies of companies in cyclical sector: An empirical study of construction industry in the United Kingdom. *Journal of Business and Industrial Marketing,* 20(3): 118-126.

Boduszek, D. (2017). *Non-parametric test in SPSS (between subjects*). University of Huddersfield. Available online at: http://webzoom.freewebs.com/danielboduszek/documents/Nonparametric%20tests%20between%20subjects%20SPSS%20-%20D.%20Boduszek.pdf [Accessed 23 February 2017].

Dikmen, I., Birgonul, M.T. & Ozcenk, I. (2005). Marketing orientation in construction firms: Evidence from Turkish contractors. *Journal of Building and Environment*, 40: 257-265.

Dulaimi, M. F. & Shan, H. G. (2002). The factors influencing bid mark-up decisions of large and medium-size contractors in Singapore. *Construction Management*

and Economics, 20(7): 601–610. Available online at: http://dx.doi.org/10.1080/01446190210159890.

Emmanuel, O. S. & Adebayo, A. A. (2011). ICT's service delivery and operational performance in Nigerian banks: A survey of empirical research. *An International Multidisciplinary Journal, Ethiopia*, 5(4): 44-59.

Fellows, R. R. & Liu, A. (2008). *Research methods for construction* (3rd ed.). London: Wiley-Blackwell Science.

Ganah, A., Pye, A. & Walker, C. (2008). Marketing in construction: Opportunities and challenges for SMEs. In: *Proceedings of the Construction and Building Research Conference of the Royal Institution of Chartered Surveyors – COBRA,* Dublin.

Ibironke, O. T., Ekundayo, D. & Awodele, O. A. (2011). A survey on the use and impact of information technology in quantity surveying service delivery in Nigeria. *In: Proceedings of the 27th Annual ARCOM Conference,* 5-7 September 2011, University of the West of England, Bristol, UK.

Jaafar, M., Aziz, A. R. A. Z. & Wai, A. C. S. (2008). Marketing practices of professional engineering consulting firms: Implement or not to implement? *Journal of Civil Engineering and Management*, 4(3.3): 199 – 2006.

Kotler, P. & Keller, K. (2009). *Marketing management* (13th ed.). Upper Saddle River, NJ: Pearson Education.

Lee, J., Je, H. & Shin, D. W. (2008). *Marketing strategy of housing construction firms and consumers' residential consciousness: Evidence from apartment residents in Korea.* Ajou University: Suwon, Korea.

Mahmood, M., Mohammed, H. S. & Hameed, D. (2017). Construction marketing: Developing a reference framework. *Hindawi advances in civil engineering.* Available online at: https://doi.org/10.1155/2017/7548905.

Meshksar, S. (2012). *Cost and time impacts of reworks in building a reinforced concrete structure*. Master's thesis submitted to the Eastern Mediterranean University, Gazimagusa, North Cyprus.

Morgan, R. E. (1990) Marketing professional services: An empirical investigation into consulting engineering services In: *Proceedings of the Annual Conference of the Marketing Education Group,* Oxford Polytechnic, pp. 973-995.

Moser, C. A. & Kalton, G. (1999). *Survey methods in social investigation* (2nd ed.). Aldershot: Gower Publishing Company.

Nisa, Z., Roshani, P. & Thurairajah, N. (2006). Career paths in quantity surveying. In: Rameezdeen, R. & Seneviratne, I. (Eds.). *Customising the Qs to face challenges in year 2020.* Colombo: University of Moratuwa.

Nnadi, E. O. E., Okeke F. N. & Alintah-Abel, U. (2016). Marketing quantity surveying profession in South-Eastern Nigeria. *IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE)*, 13(3): 12-20. Available online at: DOI: 10.9790/1684-1303031220.

Ode, M.O. (2007). *Fundamental of marketing principles and applications*. Kaduna: Polytechnic.

Ogbu, C. P. (2015). Application of marketing strategies in Nigerian quantity surveying firms. *Journal of Economics and Sustainable Development*, 6(16): 30-43.

Ogbu, C. P. (2017). Marketing strategies and performance of indigenous construction firms in Nigeria. *Journal of Construction in Developing Countries*, 22(1): 1–19.

Ojo, G. K. (2011). Effective marketing strategies and the Nigerian construction professionals. *African Journal of Marketing Management*, 3(12): 303–311.

Olaniyi, J. O. (2014). *Developing a framework for the marketing of quantity surveying services*. MSc thesis submitted to Ahmadu Bello University, Zaria, Nigeria.

Olaniyi, J. O., Sanni, M. & Garba, A. (2011). Marketing of professional services in Nigeria. (A case study of quantity surveying profession) Environ - Tech CES, *Kaduna Polytechnic Journal,* 1(2): 35-42.

Perkinson, C. L. & Ahmad, I. U. (2006). Computing technology usage in construction contractor organizations. In: *Proceedings of the Fourth LACCEI International Latin American and Caribbean Conference for Engineering and Technology (LACCET'2006) Breaking Frontiers and Barriers in Engineering: Education, Research and Practice*, 21-23 June 2006, Mayagüez, Puerto Rico.

Polat, G. & Donmez, U. (2010). Marketing management functions of construction companies: Evidence from Turkish contractors. *Journal Civil Engineering Management*, 16(2): 267–277.

Saidu, I. & Shakantu, W.M.W. (2016a). A study of the relationship between material waste and cost overruns in the construction industry. In: Windapo, A.O. (Ed.). *Proceedings of the 9th CIDB Postgraduate Conference: Emerging trends in construction organisational practices and project-management knowledge area*, 12-4 February, Cape Town, South Africa, pp.124-134.

Saidu, I. & Shakantu, W.M.W. (2016b). A conceptual framework and a mathematical equation for managing construction-material waste and cost overruns. World Academy of Science, Engineering & Technology. *International Journal of Social Behavioural, Educational, Economic, Business and Industrial Engineering*, 10 (2): 555-561.

Saidu, I. & Shakantu, W. M. (2016c). The contributions of material waste to project-cost overrun in Abuja, Nigeria. *Acta Structilia*, 23(1): 99-113.

Winter, C. & Preece, C. N. (2000). Relationship marketing between specialist subcontractor and main contractors - comparing UK and German practice. *Journal of Construction Marketing*, 2(1): 1-11.

Yan, S. & Chew, D. A. S. (2011). An investigation of marketing strategy, business environment and performance of construction SMEs in China. *African Journal*

of Business Management, 5(6): 2396-2405. Available online at: DOI: 10.5897/AJBM10.1153.

Yisa, S. B., Ndekugri, I. & Ambrose, B. (1996). A review of changes in the UK construction industry: Their implications for the marketing of construction services. *Journal of Marketing*, 30(3): 47-64.

Zeithaml, V. A., Parasuraman, A. & Berry, L. L. (1985). Problems and strategies in services marketing. *Journal of Marketing*, 49: 33-46.