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THE PEER REVIEW PROCESS

To uphold and guarantee the quality of the conference proceedings and comply with the criteria for the Department of Higher Education and Training (DHET) subsidy in South Africa, a rigorous two-stage peer review process by no less than two recognized experts was followed. The process was executed by ensuring that each abstract was twice blind reviewed with particular reference to relevance to conference themes and objectives, scientific rigor, originality of research output and extent of contributions to knowledge.

Authors, whose abstracts were accepted, after the stage one review process was completed, were provided with anonymous reviewers' reports and requested to submit their full papers that complied with the recommendations of the reviewers. The review of the full papers followed the two-tier blind review process again. Authors whose papers were accepted after this second review were provided with additional anonymous reviewers' comments and requested to submit their revised full papers.

These final papers were only included in the conference presentation programme and the conference proceedings after evidence was provided that all comments were appropriately responded to, having been double peer-reviewed for publication. Authors' feedback box on the online submission system was used to capture the extent of revision in each paper. The CMT online system was fully utilized for the peer review of all submissions for the conference. The submissions were made to:

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The members of the Scientific Committee were not involved in the review related to their own authored or co-authored papers. The role of the editor was to ensure that the final papers incorporated the reviewers' comments and arrange the papers into the final order as captured on the Table of Contents. Of the 69 submissions initially received, only 29 papers were accepted for inclusion in the proceedings. This statistic results in an acceptance rate of 42% / rejection rate of 58%. To be eligible for inclusion these papers were required to receive a minimum score of 3 out of 5 allocated by the peer reviewers during the final review process.

November 2016

Dear Author,

RE: PEER REVIEW PROCEDURE FOR THE 5th CM CONFERENCE

The academic programme chair of the 5th CM conference confirms that the following peer review process was strictly undertaken in this conference. A rigorous two-stage peer review process by no less than two recognized experts was followed. The process was executed by ensuring that each abstract was twice blind reviewed with particular reference to relevance to conference themes and objectives, apart from scientific rigor, originality of research output and extent of contributions to knowledge. Authors, whose abstracts were accepted, after the stage one review process was completed, were provided with anonymous reviewers' reports and requested to submit their full papers that complied with the recommendations of the reviewers. The review of the full papers followed the two-tier blind review process again. Authors whose papers were accepted after this second review were provided with additional anonymous reviewers' comments and requested to submit their revised full papers.

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Best wishes,

Prof Fidelis Emuze
Chair: Academic Programme
Bloemfontein, South Africa

Clients' Knowledge of Procurement Systems and Its Influence on Construction Project Performance

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Abstract:
The choice of construction procurement system varies from one project to the other, depending on a number of information clients have on general operations within the built environment circle, and this could influence project performance either positively or negatively. This study investigates the procurement system frequently used on construction projects in South Africa and whether clients' knowledge about construction procurement systems influence project performance objectives. Extant literature was reviewed to establish the most important project performance objectives, the common procurement systems used in the construction industry and factors within project procurement systems that influence project performance objectives. Data collected from three expert clients in the South African construction industry was analysed using Analytical Hierarchy Process (AHP) to determine the rank of client project performance criteria, while Pearson Product Moment Correlation was used in establishing the relationship between the level of clients' knowledge and project performance. It was found that the common procurement systems used are traditional, followed by management oriented and integrated procurement systems. In addition, it emerged that the client's knowledge, within procurement systems influence the achievement of project performance objectives. Based on these findings, the study concludes that there is some inappropriateness in the procurement systems being selected by clients in South Africa. If procurement systems are better selected, it could give better chances of successful project outcomes.

Keywords:
AHP, Clientele, Knowledge, Performance, Procurement, Risk

1 Introduction

Building procurement system is the combination of activities carried out to attain a new building (Masterman, 1992). The process requires the active involvement of project owners (clients) as they set the pre-conditions directed towards the effective attainment of specific project objectives (Ratnasabapathy & Rameezdeen, 2010). According to the CIOB (2010), procurement involves the selection of the most suitable organizational structure which will be responsible for the design and construction of the project. Procurement systems used in the construction industry are broadly characterised as Traditional (Separated and cooperative) procurement systems, Integrated (design and build) procurement systems and Management Oriented (Love *et al*., 1998; Alhazmi & McCaffer, 2000; Cooperative Research Centre (CRC), 2008; Windapo & Rotimi, 2012).

According to Bowen *et al*. (1999), CIOB (2010) and Thwala and Mathonsi (2012), building procurement systems have inherent characteristics which allow them to meet certain project performance criteria. The Construction Industry Development Board (cidb) (2014) established that in the South African context, the selection of procurement methods is influential to achieving clients' and project objectives. Bowen *et al*. (1999), Windapo and Rotimi (2012) and Mathonsi and Thwala (2012) identify factors within procurement systems that address the

achievement of different client and project objectives, such as project characteristics, client characteristics and ease of administration.

Lam *et al*. (2003) and Luu *et al*. (2003) noted that common occurrences of client dissatisfaction coupled with a wide range of procurement systems to select from, results in the construction industry seeking to select more efficient approach to procurement systems, in order to better the performance criteria on building projects. Rwelamila and Meyer (1999), Chan (2000) and Lam *et al*. (2003) have noted that the emergence of new procurement systems has led to a shift from traditional methods to more efficient integrated systems that enables better achievement of project objectives.

Rwelamila and Meyer (1999) found that there is little knowledge of the different procurement systems and their variations and that there is inappropriateness in the selection of procurement systems. In South Africa, where there is a focus on traditional procurement systems in project delivery (Rwelamila & Meyer, 1999), the cidb Construction Industry Indicators (CIIs) highlighted the dissatisfaction of clients to the quality of works delivered, condition of the facility at handover, non-resolution of defective work during the construction period by the main contractor and the overall poor quality of materials used (cidb, 2011). It has therefore become less viable to use traditional procurement systems. There is limited research, and in the context of the South African construction industry, into whether clients' knowledge of construction procurement systems, which determines their selection of appropriate procurement systems influences project outcomes. This study intends to fill this gap in knowledge by examining whether the knowledge of the client about project procurement systems influence project performance objectives.

The study proposes that clients' knowledge of procurement system is a key factor within procurement systems that impacts on project performance. To conduct the study and test this proposition, firstly, an analytical review of extant literature pertaining to construction procurement systems and factors within the system that impacts on project performance, is undertaken. Thereafter, empirical data through a quantitative research approach that includes expert interviews and questionnaires are collected, and finally, the deductions from the findings, provide conclusions and recommendations that address the problems of the study.

2 Procurement systems, client project performance criteria and factors within procurement systems that impact on project performance

This section presents a review of the main procurement systems used in the construction industry, the client project performance criteria and factors within procurement systems that affect project performance objectives. Finally, it presents a theoretical framework that details the elements and relationships to be investigated in the research.

2.1 Overview of procurement systems

The following subsections outline the procurement systems used in the construction industry.

Traditional procurement systems

The traditional method of procurement has been in existence and was the only procurement system available to clients for many years. According to the CRC (2008) and CIOB (2010), it is the system which is best understood by clients. Notably, the traditional system has classifications that separate the functions of design and construction (Mfongeh, 2010; Windapo

& Rotimi, 2012). Two separate organizations (design and construction) enter into different contracts with the client (Mathonsi & Thwala, 2009). The variants of the traditional procurement system are the lump sum, provisional quantities and cost reimbursement.

Integrated Procurement Systems

In Integrated procurement systems, the project design and execution phases are handled by one organization which takes responsibility for both aspects of project procurement. The client can, therefore, enter into one agreement with an organization which will facilitate the project delivery process. The underlying concept is that one organization will be responsible for the project in terms of outlining client requirements, design and construction. The main contractor responsible for the project can have different contracting teams involved in the project (Lam *et al.*, 2003). Each of these systems facilitates the project delivery process in a cohesive manner by integrating the design and construction phase (Molenaar *et al*., 1999; Thwala & Mathonsi, 2012). There are a number variant strategies that can be defined under the integrated procurement system. The range of variants which include, design and build, build operate and transfer, public-private partnership, private finance initiative, and package deal or turnkey procurement.

Management Orientated

Management oriented procurement systems, have a structure in which the project would be managed by a construction manager. The construction manager works with the design team and other consultants in producing designs and the team also manage the physical work carried out on site by the contractors (Mathonsi & Thwala, 2012). The CRC (2008) mentions that there are several forms of management procurement systems which include management contracting, construction management and design and manage. In management contracting, the main contractor has direct contractual links with all the sub-contractors and is in charge of all the works on site.

Commonly used procurement systems in South Africa

Procurement systems used in South Africa are derived from British Models (Rwelamila & Meyer, 1999; Mathonsi & Thwala, 2012). In previous studies done by Rwelamila and Meyer (1999), Grobler and Pretorius (2002), Mbanjwa and Basson (2003) it was found that Southern Africa utilizes the traditional procurement more often than other procurement systems followed by management oriented and integrated systems. These studies reflect that traditional procurement system is still the preferred and widely used procurement method in South Africa.

2.2 Client project performance criteria

According to Bowen *et al*. (1999), Brown and Adams (2000) and Ng *et al.* (2002), there is always an expectation that time cost and quality would be considered as project performance criteria and in literature, these criteria are cited more often than others. According to Chan *et al*. (2002), the priority of the project performance criteria – cost, time, quality, health and safety, environmental considerations, and sustainability, which represents client needs, differs depending on the perspectives of the client. Understanding criteria which are prioritized by clients should assist clients in developing a method of selecting best fitting procurement systems for their projects.

2.3 Factors within procurement systems that impact on project performance

Studies by Masterman (1992), Windapo and Rotimi (2012) and Love *et al*. (1998) suggest that there is a relationship between project success and the procurement system chosen for the delivery of the project. According to CRC (2008), each type of procurement system has its strengths and weaknesses depending on its inherent characteristics, making some procurement systems better suited to a set of performance objectives than others. Thwala and Mathonsi (2012) found that the factors which would influence the selection of the applicable procurement, are factors which touch on all stages of the project.

In several studies (e.g. Mbachu & Nkado, 2006; CRC, 2008; Thwala & Mathonsi, 2012; and Kumaraswamy & Dissanayaka, 1998), a number of factors which can be applicable to various types of procurement systems are identified, these factors consist of - clients level of knowledge (represents the client's level of knowledge and their ability to communicate their needs); client's level of control (the responsibility which the client assumes on the project); risk allocation (gives an indication of how much risk and whether the risk has been fairly assigned to the contractor and other parties in the project organisation); accelerated project delivery (the need for a project to be completed in a shorter duration than another project of an identical nature, technical complexity and size); technical complexity of the project (translates into the client's need for the project to be highly specialized and technologically advanced; political considerations (external and uncontrollable environmental factors which host issues relating to empowerment, business controls, fiscal policies, taxes, statutory regulations, which influences the client and the client's business during the project); and social consideration (socio-political or socio-cultural factors such as cultural influences, social stigma, gangsterism, workers' morale to work, health and labour union demands, which can affect the internal environment of the project).

2.4 Analytical and conceptual framework of the study

The impact of the client's knowledge and their ability to communicate their needs on project performance, within the three identified procurement systems are further investigated in this study. The conceptual framework upon which this study is based is adapted from studies by Kumaraswamy and Dissanayaka (1998), Bowen et al. (1999), The CRC (2008), Mfongeh (2010) and Mathonsi and Thwala (2012). Previous research by Kumaraswamy and Dissanayaka (1998), further supported by Mathonsi and Thwala (2012) show that clients' level of experience/knowledge have an impact on most of the sub-systems of a procurement system. There is, however, limited research that examines whether the level of experience/knowledge possessed by a client influences project performance.

3 Research Methodology

The study employs a quantitative research approach involving expert interviews and a questionnaire survey in collecting empirical data from a sample of expert clients, expert client representatives and experienced construction professionals. The objective of the study required a population knowledgeable in the outcomes of procurement systems used on construction projects. The sample size of the study consisted of 693 quantity surveyors, construction managers, project managers, architects and engineers randomly selected from a population of 2563 construction professionals listed in the Professions and Projects Register 2015 Directory in South Africa. At the end of the survey period, 121 responses were obtained, which translates

into a 17.5% response rate. The questionnaire survey gathered information pertaining to the professionals' knowledge of the range of available procurement systems and the performance of projects on which they were used.

Data collection was done in two rounds. The first round consists of conducting expert interviews to determine the important client objectives and their respective weights, based on a range of common criteria made available in the questionnaire. In the second round, questionnaires were distributed via Surveymonkey.com to evaluate the level of influence of the clients' knowledge on project performance. The respondents were asked to rate the performance of the identified project according to the client objectives of time, cost, quality, H&S, sustainability and environmental considerations. The objectives were each assigned a rating on a scale of 1 to 10. '1' being "very poor" and '10' being "excellent". The data obtained from the survey were analysed using descriptive statistics – means, percentages; the Analytical Hierarchy Process (AHP) – a multi-criteria analysis used in determining in numerical terms, the importance of each of the criteria; and inferential statistics – the Pearson Product correlation test 'ρ' to determine the strength and direction (positive or negative) of a linear relationship between the level of client knowledge and project performance index (PPI).

4 Findings and Discussion

In this section, the empirical data collected through the questionnaire survey are presented, analyzed and discussed.

4.1 Demographics of Survey Respondents

The data obtained in the questionnaire survey indicated that 27% of the respondents were quantity surveyors and another 27% were construction managers, 11%, 13%, 9% were project managers, engineers, and architects respectively. A further 13% were other professionals such as health and safety managers working in the construction industry. The data collected also shows that 63% of the respondents have more than 21 years of experience and 78% have worked on more than 21 projects in the construction industry. These results suggest that the respondents must have been fully exposed to different construction experiences, knowledge, and projects and could, therefore, provide valuable information relevant to this study.

4.2 Analytic Hierarchy Process (AHP)

The AHP questionnaire used for ranking client performance factors was completed by 3 clients who included 2 Quantity Surveyors working in the private sector as client representatives and a construction manager working in the private sector. Pairwise comparisons included client performance criteria established in literature review as shown in Table 1.

Table 1. Matrix for Average Aggregate Scores

Client Performance Criteria	**Time**	**Cost**	**Quality**	**H&S**	**Sustain-ability**	**Env. considerations**	**Weight**
Time	1.000	0.667	4.000	2.733	2.667	3.333	0.281
Cost	1.500	1.000	3.667	3.000	3.333	4.000	0.329
Quality	0.250	0.273	1.000	3.333	3.000	3.333	0.164
H&S	0.366	0.333	0.300	1.000	1.111	2.000	0.086
Sustainability	0.375	0.300	0.333	0.900	1.000	2.333	0.086
Environmental	0.300	0.250	0.300	0.500	0.429	1.000	0.055

Considerations							

Key: H&S = Health and Safety

All the respondents' pairwise comparisons of the criteria were averaged and a mean score was developed for each. Table 1 shows the matrix developed for all the three respondents and the clients' performance criteria weighting in the following order: cost, time, quality, H&S, and sustainability ranked equally and finally environmental considerations. The order outlined by the rank of the client performance criteria is understood to be the order as perceived by expert client representatives to be important for client satisfaction.

4.3 Projects studied and level of performance

The respondents were asked to consider a particular project which they are familiar with. This was so that the respondents would be in a particular mind set when answering the questions that followed. Based on this inquiry, it was found that 70% of the projects identified by the respondents were procured using the traditional procurement system, followed by management oriented (18%) and integrated procurement systems (12%). It was also found that 65.5% were public sector projects while 34.5% were private sector projects. Table 2 gives a summary of the responses collected in the survey, categorized according to the particular procurement strategy used for the projects and a weighted mean average that indicates how each of the client's objectives performed in the different procurement systems and overall in the Project Performance Index (PPI).

Table 2 suggests that overall, in terms of total aggregate performance levels, the integrated procurement method was perceived to provide clients with the best project outcomes, followed by the management oriented and lastly, by the traditional method of procurement. In terms of client criteria, it was found that integrated methods of procurement achieved the best overall outcome in five key areas of time, cost, quality, sustainability and environmental considerations.

Table 2. Average PPI Scores based on Client Criteria distributed by Procurement Methods

Procurement Method	Time	Cost	Quality	H&S	Susta-inability	Environmental Considerations	PPI
(AHP Weights)	0.281	0.329	0.164	0.086	0.086	0.055	
Traditional	6.94	7.37	7.71	7.73	7.33	6.94	7.314
Integrated	7.73	8.00	8.55	8.36	8.64	8.18	8.117
Management Oriented	7.56	7.31	8.25	8.44	8.06	7.81	7.733
Average Scores	7.41	7.56	8.17	8.18	8.01	7.64	

Source: Researcher

4.4 Relationship between the Level of Client's Knowledge and Project Performance

The level of the client's knowledge and experience of project procurement systems were plotted against their corresponding Project Performance Index (PPI) according to the procurement methods used and illustrated in Figures 1 to 3, while the test of correlation of the relationship between client's knowledge and PPI is presented in Table 3.

Table 3. Pearson Relationship between PPI and Client Knowledge distributed by Procurement Methods

Variable	R calculated	d.f.	R tabulated	Significance
Traditional Procurement	0.366**	60	0.325	0.01
Integrated Procurement	0.872***	9	0.872	0.001
Management Oriented System	0.535*	14	0.514	0.05

Source: Researcher

Table 3 shows that the knowledge of the client as a procurement system factor are significantly and positively related to project performance. However, this knowledge has a more significant level of relationship in the integrated procurement system followed by the traditional procurement and then management oriented procurement system. Further interrogation of the data collected (see Figures 1-3) also show that a positive relationship exists between the knowledge of the client and project performance within the different procurement systems. The slope of the trend line suggests that the more the clients' knowledge of procurement system, the higher is the project performance. Figure 2 also shows that 77% of the change in the project performance within projects procured through the integrated methods of procurement is explained by changes in Clients' knowledge levels.

4.5 Discussion of Findings

The survey findings suggest that cost is the highest weighted construction project performance criteria, followed by time and cost; and that the traditional procurement systems is frequently used on projects in South Africa. Furthermore, integrated procurement systems provide clients with the best overall project outcomes; and that there is a significant positive relationship between the clients' knowledge of procurement systems and project performance within the different procurement systems. However, the integrated procurement system shows the best fit between clients' knowledge levels and project performance. Findings of this study align with previous studies by Rwelamila and Meyer (1999), Grobler and Pretorius (2002) and Mbanjwa and Basson (2003), who found that Southern Africa utilizes traditional procurement more often than other procurement systems, followed by management oriented and integrated systems. It also aligns with earlier studies that consider time, cost and quality as key project performance criteria (see Bowen *et al*., 1999; Brown & Adams, 2000; Chan *et al*., 2002; Ng *et al*., 2002).

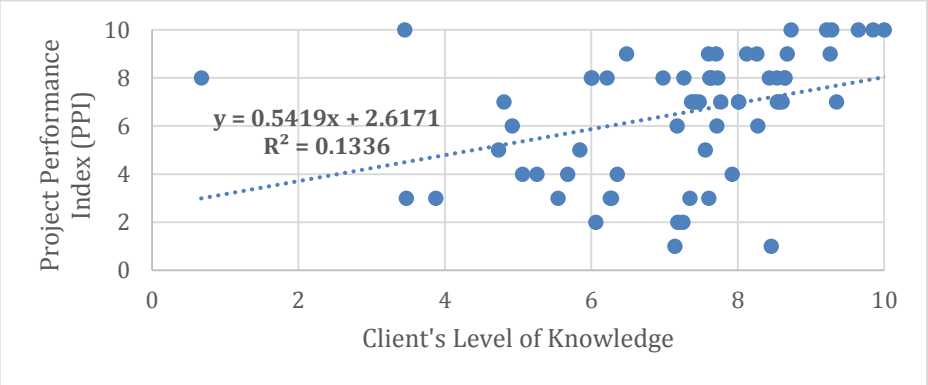

Figure 1: Relationship between level of Client's knowledge and PPI in Traditional procurement systems

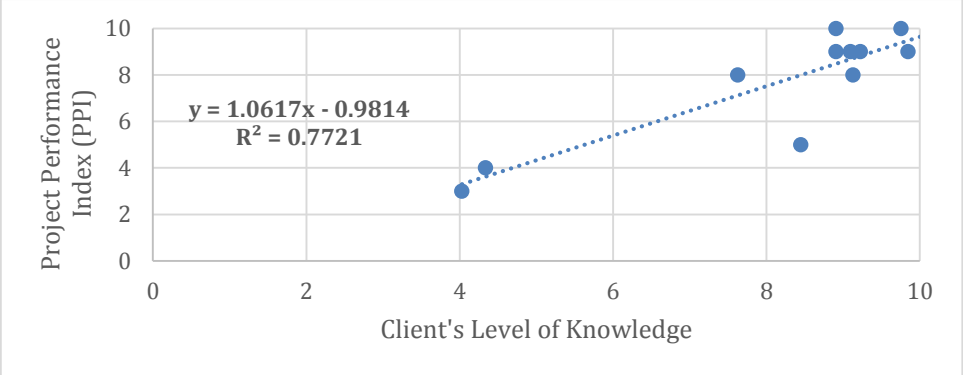

Figure 2: Relationship between level of Client's knowledge and PPI in Integrated procurement systems

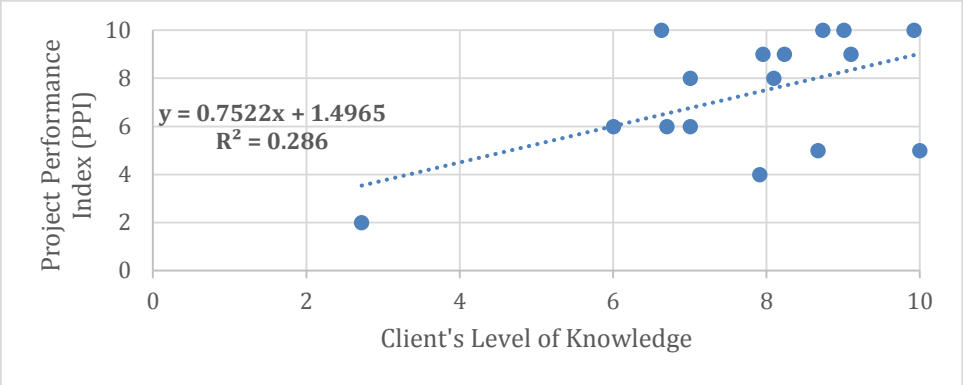

Figure 3: Relationship between level of Client's knowledge and PPI in Management oriented procurement systems

In addition, the results of this study confirm the results of previous studies such as Masterman (1992), Love *et al*. (1998) and Windapo and Rotimi (2012), that there is a relationship between project success and factors such as clients' knowledge levels and their ability to communicate their needs, which would influence the selection of an appropriate procurement method. There were no previous studies that considered whether the level of knowledge possessed by a client influences project performance, which are key findings of this study.

5 Conclusion

This study examines the procurement systems frequently used on construction projects in South Africa and whether clients' knowledge of procurement systems influence project performance. The study found that traditional procurement is the most frequently used procurement system on projects in South Africa and that the clients' knowledge of procurement system is significantly and positively related to project performance and project performance has the best fit with client's knowledge level within the integrated procurement system. Based on these findings, it can be concluded that the client's limited knowledge of procurement systems in South Africa, influence their selection of inappropriate procurement systems in project delivery, despite the emergence of more efficient procurement systems. It is therefore recommended that clients should make better-informed decisions, in order to increase the chances of successful project outcomes. The research conducted is limited to projects in South

Africa and therefore, caution should be taken when generalizing the findings and conclusions drawn to another context.

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