

*Full Length Research Paper*

# Factors influencing the selection of procurement systems in the South African construction industry

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Procurement systems are vital in ensuring the successful implementation of a construction project, precisely executed for all phases of any particular project. Therefore, this paper aims to investigate, in a systematic manner, the factors that influence the selection of a procurement system in the South African construction industry. An extensive theory and literature review of procurement systems was conducted. The literature reviewed included a sample of 6 case studies of completed building and civil engineering projects within South Africa. Questionnaire surveys were carried out using a 4-round Delphi method approach to conduct the empirical study in order to obtain participants' opinions about the factors that influence the selection of procurement systems, as well as the utility value of various procurement systems on each factor as identified. Finally, data analysis of both qualitative and quantitative techniques was performed using the Statistical Package for Social Sciences (SPSS). After qualitative analysis, the findings indicate that factors that influence the selection of procurement systems are closely linked to the problem areas or they cut across all the phases of the project as identified in this paper. Therefore, these factors are categorically classified into internal and external factors. Factors from the internal environment were further classified into client characteristics and project characteristics, with client characteristics comprising variables such as: client's level of knowledge and control, political and social consideration, familiarity of procurement systems, competition, funding arrangements, government (public/private sector projects) and risk allocation; whereas project characteristics comprise factors (variables) such as: size and technical complexity of the project, influence of the project life cycle, expedited project delivery, time, quality and price certainty. Factors from the external environment include variables such as market competition, information technology, regulatory environment, natural causes and globalization. After factor analysis had been performed on variables obtained from the literature review, five newly established factors were identified and are considered to be the most significant factors that influence the selection of a procurement system for the South African construction industry. These 5 factors are: socio-economic consideration, client requirements, capital cost/cash flow, procurement policy and project characteristics. In terms of its scope, this study focused on both national and international literature reviews and the empirical survey of this study was conducted within South Africa. However, its target participants were limited to civil engineers, quantity surveyors, construction/project managers, architects and contractors located in three provinces of South Africa, namely: Gauteng, Mpumalanga and Limpopo. This study investigates factors that influence the selection of procurement systems in South Africa for the purpose of assisting and guiding construction practitioners in selecting suitable procurement systems for their planned projects.

**Key words:** Procurement systems, traditional, non-traditional, construction projects, South Africa, internal and external factors.

## INTRODUCTION

To some extent, procurement systems are not foreign to the South African construction industry. Two studies

conducted within the SADC region, one for South Africa and the other for Botswana by Rwelamila and Meyer (1996) have revealed that South Africa had adopted a ready-made construction framework, including the hybrids of traditional procurement systems during the years when South Africa was a British colony. Although the South African procurement system is based on the British model, the context and the application of this model were unsystematic for the then apartheid South Africa; this was due to the different set-up and institutional arrangements between South Africa and Britain.

However, the political uncertainties that had taken place during the early 1980s and late 1990s led to some changes within the South African construction industry. This was due to the South African construction industry shifting its focus from a predominantly first-world oriented construction environment to a developing-world construction environment that focuses on the basic needs of the population and its economic circumstances. Among other things, this shift was directed towards the development of new construction policies aimed at promoting stability; fostering economic growth and economic competitiveness; creating new sustainable employment; as well as addressing the historic imbalances as new industry capacity is being generated for development (Department of Public Works (DPW), May 1999).

Post-1994, the newly formed South African Government of National Unity and all stakeholders of the construction industry headed by the Department of Public Works, initiated and co-ordinated the development of the Construction Industry Development Board (CIDB) which was mandated among other things to improve a standardised application of best practice in construction procurement within the framework of government procurement policy (Construction Procurement Library, CIDB, 2005). Therefore, this study aims to investigate in a systematic manner the factors that influence the selection of procurement systems within the South African construction industry.

## LITERATURE REVIEW ON PROCUREMENT SYSTEMS

'Procurement system' is a contemporary term, which is known to many practitioners and researchers of the construction industry by different terms; these include terms such as project approach, procurement methods, procurement delivery methods or project delivery

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**Abbreviations:** **DBP-FOT**, Design build, part-finance, operate and transfer; **DBFOT**, design, build, finance, operate, and transfer; **CM**, construction management; **DCOMF**, design, construct, operate, maintain and finance.

systems, etc. The following definitions best define a procurement system:

1. It is an organizational structure adopted by the client for the implementation and at times eventual operation of a project (Masterman, 2002).
2. It is a key means through which the clients create the pre-conditions for the successful achievement of project-specific objectives (Rameezdeen and Ratnasabapathy, 2002, 2006).

Procurement systems govern the delivery processes of a construction project in many ways and are the key in determining the success or failure of any particular project. Procurement systems have received well-deserved attention in countries such as Australia, United Kingdom, United States of America, Japan and New Zealand, but this has never been the case locally as well as in many other African countries.

With a plethora of different procurement systems from which to choose to deliver diverse construction projects, an extensive literature review on procurement systems indicates that there is currently no systematic and no realistic approach applied or used to select the appropriate procurement system; in fact, the literature reviewed further highlighted that factors that influence the selection of procurement systems cut across all the project phases identified in this study. This is further exacerbated by the poor contractual relationship between the parties to the contract. Procurement systems are basically classified into traditional and non-traditional systems.

### Traditional procurement systems

This method is called 'traditional' because it has been in existence for a long time and has been the only choice available for most clients of the construction industry for many years. Using this method, the client enters into an agreement with the design consultant (an architect or engineer) to actually carry out the design work and prepare contract documents.

Following the completion of this phase, the contractor is then appointed based upon the owner's criteria and the owner enters into a contract with the successful contractor for the assembly of the project elements. In essence, the client is under two contractual obligations; the design professional and the contractor. In order for the client to obtain a constructed facility, tenders from this type of procurement systems are invited in one of the three following methods:

### *Open tendering*

This is a procedure that allows practically any contractor to submit a tender for the work. This procedure involve

either the client or consultant (on behalf of the client) placing a public advertisement giving a brief description of the work. Normally the client will require a cash deposit when contract documents are requested (Pilcher, 1992).

### ***Selective tendering***

This consists of the client drawing up a shortlist of contractors that are known to have the appropriate qualifications to carry out the work satisfactorily. Those contractors who seek to be listed are then asked for further details concerning their technical competence, financial standing, resources at their disposal and relevant experience. Pre-qualifying contractors who are on the list are invited to tender (Pilcher, 1992).

### ***Negotiated tendering***

This method is applied in several or different contexts, but the essence is that tenders are obtained by the client inviting a single contractor of his/her choice to submit a tender for a particular project.

### **Non-traditional procurement systems**

Non-traditional is a generic term which is used to refer to all emerging or contemporary procurement systems of the construction industry other than the traditional procurement system. Over the past number of years, the construction industry has undergone changes in a manner never seen before. The increased size and complexity of the construction projects, financial challenges, political and social consideration, and information technology are just some of the changes that have been taking place. These changes had led to the development of alternative procurement systems other than the famous traditional one. Although the development of non-traditional procurement systems seemed to be the favourite to most clients of the construction industry, it must, however, be emphasised that there is not yet a specific method used to select the most appropriate procurement system. Masterman (2002) defines a non-traditional procurement system as a diversified contemporary procurement system(s) that not only considers design and construction, but also considers financing, operating and facility management. The three different types of non-traditional procurement systems are as follows:

#### ***Integrated procurement system***

This is a system where one organization, usually but not exclusively the contractor, takes responsibility for the design and construction of the project, in theory at least. The client deals only with one organization.

#### ***Management-oriented procurement system***

Under a management-oriented procurement system, the management of the project is carried out by an organization working with the designer and other consultants to produce the designs and manage the physical operations which are carried out by contractors. When using systems within this category, the client will need to have a greater involvement with the project than when employing any of the other methods described in the previous two categories.

#### ***Collaborative/discretionary procurement system***

Under a collaborative system the client lays down a framework for the overall administration of the project within which he/she has the discretion to use the most appropriate of all the procurement systems contained within the other three categories. In a collaborative procurement system quantity surveyors play an integral role by providing a wide range of services, which include contractual issues; it also offers quantity surveyors an opportunity to act as independent advisors within the system (Cartlidge, 2002).

## **SOUTH AFRICAN PERSPECTIVES**

Although the forerunner of procurement systems in South Africa is based on the British model, post-1994, the South African government and all other stakeholders of the construction industry through the Department of Public Works initiated and co-ordinated the development of a comprehensive CIDB as part of their contribution to national project for Reconstruction, Growth and Development typified in the white paper "Creating an Enabling Environment for Reconstruction, Growth and Development in the Construction Industry (DPW, 1999).

### **Construction procurement policy in South Africa**

Procurement is defined as the process which creates, manages and fulfils construction contracts, and it is further described as a succession of logically related actions occurring or performed in a definite manner and which is culminated by methods (i.e. documented systematically), and procedures which are performed and shaped by policy of an organization (Draft International Standard ISO/DIS 10845-1, 2008). Within the South African Government context, policy is often translated into rules and regulations; policy also relates to choices made in the use of generic procedures, methods and circumstances under which a certain procedure should be used (SANS 294). Therefore it can be deduced from the two aforementioned definitions that the combination

results in a process referred to as a procurement policy, which is defined as a process which creates, and manages contracts based on the choices made in the use of generic procedures, methods and circumstances adopted in terms of 76(4) (c) of the Public Finance Management Act (PFMA).

In the field of procurement systems, South Africa like many other developing countries uses the generic procedures and standard set of processes and methods for procurement systems that are fair, equitable, transparent, competitive and cost effective when pursuing implementation of construction projects within construction industry and this is regulated in all spheres of government including state-owned enterprises through various pieces of legislation or prescripts as listed in Table 2.

### Procurement systems used in South Africa

South Africa being one of the developing countries, it therefore follows and is guided by the framework for developing effective procurement systems in developing countries (The Round Table Process, December 2000). Based on this declaration an agreement was reached for developing countries to utilize common strategies, approaches and tools in order to strengthen the procurement systems' capacities in developing countries and move towards greater reliance on national systems. With reference to SANS 294 as highlighted in the construction procurement processes, procedures and methods of the best practice guidelines # A1 (CIDB, September 2005), it provides guidance classified into three categories as shown in Table 3.

### RESEARCH METHODOLOGY

The triangulation approach was deemed appropriate to investigate factors influencing the selection of procurement systems in the South African construction industry. According to Clarke (2005), triangulation is the combination of two or more methodologies to study the same phenomena. However, triangulation can be conducted in two different approaches, namely; simultaneous and sequential triangulation. In conducting this study, the sequential triangulation approach was adopted, which involves linking qualitative and quantitative approaches. The vast body of theory and literature reviews focusing on both national and international literature was used for the qualitative approach in this study. This also included a review of 6 South African case studies of completed construction projects that had successfully used and implemented universal procurement systems.

For the quantitative approach, self-administered questionnaires through the utilization of the Delphi method were used during the empirical survey for the collection of opinions. The sample comprised a total of 40 areas of expertise, with 10 members representing each of the 4 professional bodies of the built environment, namely the SACQSP, SACCPMP, SACAP and ECSA. This is shown in Table 1. The study was limited to only 3 provinces of

South Africa, namely: Gauteng, Mpumalanga and Limpopo Provinces. The Round 1 questionnaire of the Delphi method comprised Sections A and B and was sent to participants sequentially, with Section A first and Section B second. 21 participants, equivalent to 52.5%, completed the questionnaires. The purpose of Section A was to obtain the factual biographical data profiles of the targeted respondents, and to ascertain the participant's level of knowledge about the procurement systems used in South Africa. The purpose of Section B was to determine whether the factors as revealed from the literature review existed within the South African construction industry.

Round 2 of the Delphi survey method comprised a total of 20 variables (factors) collected from Section B of Round 1. 15 variables (factors) were found to be from the internal environment and 5 variables (factors) from the external environment. Questionnaires were distributed through electronic mail to 21 participants in Round 2 and all the 21 participants completed the questionnaires. All the variables (artificial factors) were subjected to factor analysis for the purpose of obtaining the genuine smaller quantity of factors. Round 3 of the Delphi survey method consisted of 5 factors retained after factor analysis of Round 2, whereby experts were requested to rate the utility value score of each of the 5 factors. 20 questionnaires were returned, which equates to 50%. Round 4 of the Delphi survey method also consisted of the 5 factors retained from factor analysis of Round 2 for re-assessment of Round 3 scores to obtain the mean utility scores on each of the 5 factors. Out of 20 (50%) questionnaires sent, 6 participants (which equate to 30%) returned their questionnaires and the other 14 (which represented about 70%) did not return their questionnaires; therefore, their scores for Round 3 were considered for Round 4. All the questionnaires from Round 1 to Round 4 were distributed to the participants using electronic mail. Data analyses of both qualitative and quantitative techniques were performed using Statistical Package for Social Sciences (SPSS).

### Case studies of construction projects successfully implemented in South Africa using different categorizations of non-traditional procurement systems

Despite South Africa being a developing country, construction wise, South Africa has the potential to undertake both public and private sector construction projects using the categorization of universal procurement systems. This is evidenced by the empirical survey conducted by Grobler and Pretorius (1999). They established that about 30% of the respondents agreed that the traditional procurement system has been the most used and favoured form of procurement system for housing delivery projects in South Africa. The pair further indicated in their report that 62% of both building and civil engineering projects were delivered using the integrated type of procurement systems (design and build) and 8% of both building and civil engineering projects were implemented using other forms of non-traditional procurement systems, with construction management being the least-used form of procurement systems used.

Another empirical survey conducted by Mbanjwa and Basson (2003) indicates, on a scale of 1 to 5, with 1 indicating no knowledge and 5 indicating excellent knowledge, that the traditional procurement system was rated the most favoured form of procurement systems, followed by construction management, management contracting ranked third, fourth being design and build (turnkey) and design and manage including (build, operate and transfer) ranked fifth. However, the survey findings of Grobler and Pretorius (1999), Chege (2001) and Mbanjwa and Basson (2003) indicate that some of the construction projects delivered locally used different categorization and innovative procurement systems. The case studies of projects which were reviewed are listed in Table 4 indicating the type of procurement system utilised.

**Table 1.** Designation of respondents who participated in the survey of this study.

Discipline	Number	%	Public	Private
Quantity surveyors	10	47.62	1	9
CM & PM	06	28.57	1	5
Architects	03	14.29	0	3
Engineers	02	9.52	1	1
Total	21	100	3	18

**Table 2.** Prescripts regulating the South African construction procurement systems.

Act	Applicability	Purpose
Constitution of the Republic of South Africa (Act No 108 of 1996)	All organs of state	Provides procurement objectives and establishes government's policy for referencing
Public finance management act (Act No 1 of 1999)	All organs of state, except in the local government	Establishes broad framework within which accounting officers/authorities must establish their procurement and provisioning system
Construction industry development board (Act No 38 of 2000)	All organs of state involved in procurement relating to the construction industry	Establishes a means by which the board can promote and implement policies, programmes and projects aimed at procurement documentation, practices and procedures within the framework of the procurement policy of government. Establishes a national register of contractors and if required consultants and suppliers to manage public procurement risk.
Preferential procurement policy framework (Act No 5 2000)	All organs of state and state-owned enterprises at discretion of minister	Establishes the manner in which preferential procurement policies are to be implemented
Broad-based black economic empowerment (Act No 53 of 2003)	Procurement provisions apply to all organs of state	Development of qualification criteria for issuing of licenses or concessions, the sale of state-owned enterprises and for entering partnerships with private sector
		Development and implementation of preferential policy

Adapted from the Construction Procurement Best Practice Guideline #A2 (CIDB, 2007).

## FINDINGS

The theory and literature review conducted during this study revealed that factors that influence the selection of procurement systems in South Africa are classified as internal and external factors. Factors from the internal environment were further grouped into client characteristics and project characteristics. Client characteristic factors were found to consist of artificial factors (variables) such as client's level of knowledge, political and social consideration, familiarity with procurement system, competition, funding arrangements, government (public)/private sector project, and risk allocation. Project characteristics were found to be artificial factors (variables) such as size and technical complexity of the project, influence of the life cycle of the project, expedited

project delivery, time, quality, and price certainty. Factors from the external environment comprised the following variables: market competition, information technology, regulatory environment, natural causes and globalisation. The artificial factors obtained from the theory and literature review mentioned earlier were further subjected to an empirical survey consisting of 4 rounds of the Delphi method, which was used to obtain the participant's level of comprehension with regard to various procurement systems as utilised within the South African construction industry. Due to the large number of variables collected from Round 1, a multivariate method known as factor analysis was used in Round 2. This method analyzes correlated and difficult-to-interpret variables into fewer conceptually meaningful and relatively independent variables.

**Table 3.** Standard procurement procedures in South Africa.

Category	Procurement procedure	Actions
Negotiated procedure	Negotiated procedure	A tender offer is solicited from a single tenderer
	Nomination procedure	Tenders that satisfy prescribed criteria are entered into an electronic database. Tenderers are invited to submit tender offers based on search criteria and if their position is relevant on database. Tenderers are repositioned on the database upon appointment or upon submission of tender offer.
	Open procedure	Tenderers may submit tender offers in response to an advertisement
	Proposal procedure (two- envelope system)	Tenderers submit technical and financial proposals in two envelopes; financial proposal is only opened and considered if it attains minimum threshold score
Competitive selection procedure	Proposal procedure (two- stage system)	Tender offers are invited from those that submitted acceptable proposals based on revised procurement documents. Alternatively, a contract is negotiated with the tenderer scoring the highest number of points.
	Qualified procedure	A call for expressions of interest is advertised, and thereafter only those who have expressed interest, satisfy objective criteria and who are selected to submit tender offers, are invited to do so.
	Quotation procedure	Tender offers are solicited from not less than three tenderers in any manner the organization chooses, subject to the procedures being fair, equitable, transparent, competitive and cost effective
	Shopping procedure	Obtain three written or verbal quotes and confirm the lowest offer once confirmed
Competitive negotiation procedure	Restricted competitive negotiations	Tenderers who have expressed interest, satisfy objective criteria and who are selected to submit tender offers, are invited and the client evaluates offers and determines who may enter into competitive negotiations
	Open competitive negotiations	The employer evaluates the offers and determines who may enter into competitive negotiations

Source: Draft International Standard ISO/DIS 10845 – 1 (2008).

**Table 4.** Procurement systems implemented successfully on projects in South Africa.

No.	Client	Project	Procurement type	Project value
1	Gauteng Provincial Government	Gautrain	DBP-FOT	R 25 billion
2	Correctional Services	Louis Trichardt Maximum Security Prison	DBFOT	R 1.8 billion
3	Correctional Services	Mangaun Maximum Security Prison	DBFOT	R 1.7 billion
4	Limpopo Provincial Government	Eco-tourism Manyeleti	DFBOT	R 25 million
5	Telkom	Space Saver Project	CM	R 43 million
6	SANRAIL	N3 Toll Road	DCOMF	R 10 million

### Analysis of round 2

A 5-point Likert scale was used to obtain the participant's opinions in round 2, and the results of Round 2 were then descriptively and inferentially analysed. Descriptively, the

means and standard deviation scores were computed in order to determine the variability of the spread of data as shown in Table 5. Inferential statistics were also computed in order to determine whether all the participants had been drawn from the same population. Two tests,

**Table 5.** The descriptive statistics of all the factors collected from Round 1.

Variable	Obs.	Min.	Max.	Mean	Std. Deviation
Client's level of knowledge	19	1.000	5.000	4.105	1.449
Influence of the life cycle of the project	19	1.000	5.000	2.895	1.696
Government/Private sector project	19	1.000	5.000	3.579	1.427
Political consideration	19	1.000	5.000	3.368	1.707
Expedited project delivery/time constraints	19	1.000	5.000	2.895	1.883
Corruption/self enrichment	19	1.000	5.000	4.053	1.433
Size and technical complexity of the project	19	1.000	5.000	4.368	0.955
Funding arrangements	19	4.000	5.000	4.158	0.375
Familiarity of procurement system	19	1.000	5.000	3.947	1.129
Affirmative action/government policies	19	1.000	5.000	3.158	1.740
Competition	19	1.000	5.000	3.579	1.644
Risk allocation/reduction	19	1.000	5.000	4.105	1.197
Client's specific requirements	19	1.000	5.000	3.579	1.427
Client's budget/cash flow	19	1.000	5.000	4.053	1.177
Lack of resources	19	1.000	5.000	3.211	1.960
Markets/economic conditions	19	1.000	5.000	3.316	1.336
Political influences/interferences	19	1.000	5.000	3.579	1.427
Unemployment/lack of skilled labours	19	1.000	5.000	3.737	1.327
Emerging technology	19	1.000	5.000	3.368	1.707
Globalization	19	1.000	5.000	3.158	1.425

**Table 6.** Standardized Cronbach's alpha coefficient and Bartlett's test of sphericity.

Standardized Cronbach's alpha coefficient ( $\alpha$ )		0.756
Bartlett's test of sphericity	Approx. Chi-Square	76.37
	Df	19
	Sig.	0.0001

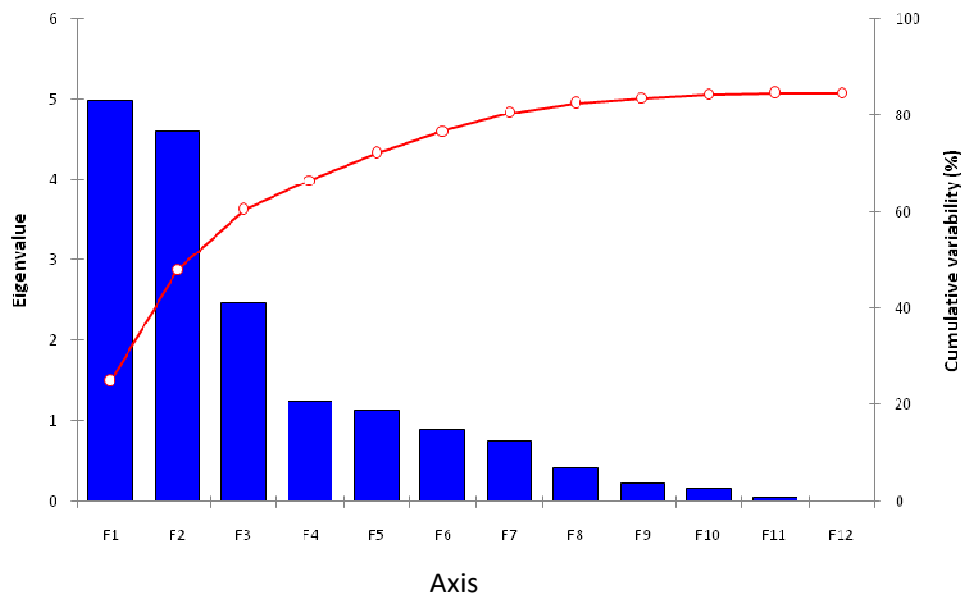
**Table 7.** Eigenvalues, variability and cumulative variability before Varimax rotation.

Factors	Eigenvalues	Variability (%)	Cumulative (%)
F1	4.989	24.947	24.947
F2	4.602	23.010	47.952
F3	2.475	12.375	60.332
F4	1.232	6.159	66.491
F5	1.124	5.620	72.111
F6	0.898	4.488	76.598
F7	0.760	3.801	80.400
F8	0.416	2.082	82.482
F9	0.226	1.130	83.611
F10	0.155	0.776	84.388
F11	0.045	0.223	84.610
F12	0.004	0.019	84.629

namely: Bartlett's test of sphericity and standardised Cronbach's alpha ( $\alpha$ ) for the entire input data set were computed producing satisfactory results as shown in

Table 6.

After the lengthy steps of principal factor analysis for Round 2 had been performed, it was established that



**Figure 1.** A scree plot from principal factor analysis.

within a set of 20 variables, only 12 variables could be extracted for further consideration. The determination of number of factors to be retained for further consideration was based on the Kaiser criterion (Kaiser, 1960) supplemented by Cattell's scree test plot (Cattell, 1966) which suggest that only factors with eigenvalues equal to or greater than 1.00 are retained for further interpretation, and later suggesting to drop all factors immediately after the break or elbow as they are considered to contain debris information as shown in Table 7 and Figure 1.

### Factor rotation

Factor rotation is the process of holding the point constants and mainly rotating the axes. The purpose of this operation is to provide a more meaningful interpretation of the factor solution (<http://www.qualtrics.co.za>). In this study a Varimax rotation was employed, which is an orthogonal rotation which produces uncorrelated factors on the factor axis in order to maximize the variance of the squared loadings. After Varimax rotation, meaningful artificial factor loadings or variables that cross-loaded on more than one factor were scratched out because they were considered to be deceitful measures of any one construct. Variables dropped out include V4, V6, V11, V12, V15 and V18 as shown in Table 8.

### Interpretation and naming of surviving variables

A 0.40 factor loading was used as a cut-off point (Stevens, 1992), therefore the surviving variables with

factor loadings of 0.40 or higher (Stevens, 1992) were considered further for interpretation and naming. The interpretation and naming of factors implied that the remaining or surviving variables with high factor loadings and common conceptual meanings were grouped together to form a genuine independent factor. Table 9 provides a summary of rotated factor patterns. After the grouping, naming and interpretation, 5 newly established factors were identified and are considered to be significant factors that influence the selection of procurement systems in the South African construction industry.

#### **Factor 1 (D1): Socio-economic consideration**

Factor 1(D1) is derived from four variables, namely: political consideration (0.944), government (public) or private sector project (0.814), market or economic condition (0.768) and emerging technology (0.743). 3 variables have the highest loading of this factor relating to political and economic issues, therefore this factor can be referred to as 'socio-economic conditions'. This factor is assessed as reliable and valid at Cronbach's coefficient alpha ( $\alpha$ ) = 0.910 with a 2nd highest factor score of 3.269.

#### **Factor 2 (D2): Client requirements**

Factor 2 (D2) for client requirements accounts for 23.27% of total variance, and variables loading on this factor



**Table 8.** Factor pattern (loadings) obtained after Varimax rotation that cross-loaded on more than one factor.

Code	Variable description	D1	D2	D3	D4	D5
V1	Client's level of knowledge	-0.339	0.791	0.107	0.173	0.277
V2	Influence of the life cycle of the project	0.214	0.178	-0.166	-0.068	0.848
V3	Government/Private sector project	0.814	0.095	-0.066	-0.208	0.112
V4	Political consideration	0.944	-0.137	-0.082	0.267	-0.068
V5	Expedited project delivery/time constraints	0.768	-0.441	-0.038	-0.027	0.031
V6	Corruption/self enrichment	0.743	0.327	0.014	-0.394	-0.405
V7	Size and technical complexity of the project	-0.116	0.039	-0.387	-0.165	0.407
V8	Funding arrangements	0.092	-0.179	0.073	-0.459	0.076
V9	Familiarity of procurement system	0.123	-0.124	0.130	0.271	0.073
V10	Affirmative action/government policies	0.378	0.222	-0.037	-0.548	0.183
V11	Competition	-0.202	0.692	0.401	0.394	-0.116
V12	Risk allocation/reduction	0.173	0.497	-0.039	0.580	-0.482
V13	Client's specific requirements	-0.047	0.950	-0.121	-0.088	0.026
V14	Client's budget/cash flow	-0.130	0.269	0.624	0.042	-0.121
V15	Lack of resources	0.462	0.270	0.313	0.602	-0.037
V16	Markets/economic conditions	0.695	0.062	0.173	-0.112	0.264
V17	Political influences/interferences	-0.047	0.950	-0.121	-0.088	0.026
V18	Unemployment/lack of skilled labours	-0.023	0.453	-0.749	0.030	0.060
V19	Emerging technology	0.944	-0.137	-0.082	0.267	-0.068
V20	Globalization	0.356	0.816	0.066	0.091	0.023

include: client's specific requirements (0.950), political interferences (influences) (0.950), globalization (0.816) and client's level of knowledge (0.791). Three variables that have highest factor loadings seem to have common conceptual meaning which clients of the construction industry deem to be the prerequisites prior to making any procurement decision. Therefore, this factor can be referred to as 'client requirements'. This factor is also assessed as reliable and valid at Cronbach's Coefficient alpha ( $\alpha$ ) = 0.916 with a highest factor score of 3.501

#### **Factor 3(D3): Capital cost**

Factor 3 (D3) explain 7.5% of the total variance with a factor loading of 0.624; however, is difficult to interpret this factor, since only one variable loads on it. One thing clear about this factor is that it is a client- and cost-related factor. If this factor measures capital cost, it would be related to variables of Factor 2. More variables would need to be loaded on this factor to interpret it in a conclusive manner.

It will, however, be referred to as 'capital cost'. Since questions were invalidly answered, they had to be omitted as being unreliable; Cronbach's coefficient alpha ( $\alpha$ ) = -0.759. Factor 3 (D3) is the 2nd lowest ranked with a factor score of 0.624. It must, however, be borne in mind that a high or low degree of internal consistency of the Cronbach's alpha ( $\alpha$ ) does not directly address the major concerns about the data except that judges were

not consistent when rating this factor.

#### **Factor 4 (D4): Procurement policy**

Factor 4 (D4) accounts for 9.409% of the total variance and is derived from two negative variables, namely affirmative action/government policy (-0.548) and funding arrangements (-0.459). Both of the two (2) variables relate to the Preferential Procurement Framework Act (Act 5 of 2000) and the Broad-Based Economic Empowerment Act (Act 53 of 2003). The former focuses on the participation of targeted enterprises and labour in the performance contract and latter focuses on promoting social and economic goals, including developing criteria or strategies for entering into partnerships with the private sector.

Therefore this factor can be referred to as 'procurement policy'. This factor had a Chronbach's coefficient alpha ( $\alpha$ ) = -0.088. Factor 4 (D4) has the lowest ranked factor score of -1.007.

#### **Factor 5 (D5): Project characteristics**

Factor 5(D5) is derived from two variables that explain 7.655% of the total variance, namely: influence of the life cycle of the project (0.848) and size and technical complexity of the project (0.407). The 2 variables loading onto this factor are those that are project-related, therefore

**Table 9.** Significant factors obtained from the surviving variables after factor analysis.

Factor code	Variable code	Variable description	Factor loadings					Factor scores
			D1	D2	D3	D4	D5	
D1	V3	Political considerations	0.944					3.269
	V4	Public /private sector projects	0.814					
	V16	Market/economic conditions	0.768					
	V19	Emerging technology	0.743					
D2	V13	Client's specific requirements		0.950				3.501
	V17	Political interferences		0.950				
D3	V20	Globalization		0.816				0.624
	V1	Client's level of knowledge		0.791				
	V14	Client's budget/cash flow			0.624			
D4	V8	Affirmative action/Government policies				-0.548		1.007
	V10	Funding arrangements				-0.459		
D5	V2	Influence of the life cycle of the project					0.848	1.255
	V7	Size and technical complexity of project					0.407	

this factor can be referred to as 'project characteristics'. This factor is moderately reliable at Cronbach coefficient alpha ( $\alpha$ ) = 0.608 with a factor score of 1.255.

### Analysis of Round 3

The utility value scores based on Table 10 of various procurement systems vs. the 5 factors using a scale of 1 to 11, with 1 representing least significant and 11 representing most significant. The results indicate that:

1. The Procurement policy (D4) with a utility value of 76.30 is the most significant factor.
2. Project characteristics (D5) with a utility value of 74.55 is ranked 2nd most significant factor.
3. Socio-economic consideration (D1) with a utility value of 73.45 is ranked 3rd.
4. Capital cost/cash flow (D3) with a utility value of 70.86 is ranked 4th.
5. Client requirements (D2) is ranked 5th with a utility value of 67.26.

Further to the significance level of each factor, Kendall's Coefficient of Concordance ( $W$ ) was computed in order to assess the level of agreement among experts (judges). According to Legendre (2005), variables or experts are in total agreement when  $H_0 \leq W \leq H_1$ , where one (1) indicates perfect agreement and zero (0) no agreement.

The test results of Kendall's coefficient of concordance ( $W$ ) = 0.657 for this study were computed, and virtually suggest a moderate level of consistency among the respondents. The mean utility value scores, standard deviations and probability values (assumed to be significant at  $P \leq 0.05$ ) were also computed for each of the 5 factors. The results given in Table 11 indicate that there is no conclusive evidence to suggest that the utility value (level of satisfaction) of various procurement systems as shown in Table 10 has any influence on each of the 5 factors during the selection of procurement systems.

### Analysis of Round 4

Round 4 was basically a refinement of Round 3, except that the same utility value scores were re-sent to all the participants of Round 3 to re-evaluate their utility value scores. If a utility value score(s) different from those registered in Round 3 is observed, a mean utility value score different from the one in Round 3 was to be computed. However, all the participants in Round 4 committed to their initial scores.

### CONCLUSIONS AND RECOMMENDATIONS

It is evident from this study that the South African construction industry has done exceptionally well in implementing world-class projects successfully while utilising various procurement systems. Based on the

**Table 10.** Utility value scores for various procurement systems against each of the significant factors.

Important factors that influence the selection of procurement systems in S.A	Procurement systems									
	Integrated			Management- oriented			Separated		Collaborative	
	D & B	D & C	PPP	CM	MC	D & M	LS	PC	P	JV
Capital cost/cash flow (D3)	7.98	8.89	6.43	7.83	7.13	8.18	7.08	5.78	5.93	5.63
Client requirements (D2)	6.58	7.10	7.08	6.05	6.75	7.25	8.20	5.45	5.60	7.20
Socio-economic consideration (D1)	8.35	8.15	6.35	7.85	7.85	7.85	7.95	5.95	7.00	6.15
Project characteristics (D5)	8.45	7.95	6.95	8.35	8.35	7.65	6.90	7.25	6.20	6.50
Procurement policy (D4)	8.40	8.45	7.80	7.50	7.50	8.35	7.25	7.40	6.20	6.50

Legend: Design and Build (D&B), Design and Construct (D & C), Public Private Partnerships (PPP), Construction Management (CM), Management Contracting (MC), Design and Manage (D&M), Lump Sum (LS), Prime Cost (PC), Partnering (P), Joint Venture (JV), Kendal's Coefficient of Concordance (w) and Significance level ( $\alpha$ )

**Table 11.** Mean utility value score, standard deviation and probability values for various procurement systems against each of the significant factors.

Factors	Mean utility value	SD ( $\sigma$ )	(p-value)
Capital cost/cash flow (D3)	7.086	0.895	0.392
Client requirements (D2)	6.726	0.903	0.395
Socio-economic consideration (D1)	7.345	0.837	0.367
Project characteristics (D5)	7.455	0.814	0.357
Procurement policy (D4)	6.785	0.571	0.250

findings of the literature review and empirical survey findings, it was established after factor analysis that 5 factors significantly influence the selection of procurement systems. The 5 factors in the order of importance in terms of their utility value scores are: procurement policy, project characteristics, socio-economic consideration, project characteristics, capital cost, and client requirements.

The study further revealed that, although the procurement choice or the utility value (level of satisfaction) by different procurement decision makers is not in total agreement with each other,

the utility value of any particular procurement type does not have a significant influence on the choice of procurement system. Based on that, the following implementation measures are recommended:

1. Construction planners, managers and all other stakeholders involved in procurement decision-making should formulate a systematic selection approach, as this will assist in eliminating unnecessary project demands.
2. Clear contractual arrangement should be set out right from the start as this will consequently

assist with the determination of responsibilities of all project participants.

3. All clients of the construction industry, whether from the public or the private sector, should familiarise themselves with various procurement systems as this will assist them in making well-informed procurement decisions.

4. Client's actual needs, requirements, objectives and project goals must be accurately conveyed to the project team in order to enable the project team to develop a sound procurement strategy.

5. The procurement selection criteria should contain contingency measures in order to

counteract any unforeseen circumstances, should these factors present themselves to the project.

6. A clear 'general strategy' be established at a very early (planning) stage of the project which will determine broadly what has to be done, how it must be done, by whom it must be done, where it must be done and when it must be done.

However, it must be borne in mind that the main focus of this study was not on investigating the most appropriate procurement selection criteria, but rather on investigating the factors that influence the selection of procurement systems. Therefore, further research that will focus on selection criteria of procurement systems in South Africa should be considered.

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