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Management concepts and project performance: perceptions from the South African public sector environment

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The thrust of this paper is to examine management strategies that could engender performance improvement in construction. Using the South African infrastructure sector as the geographical limit of the study, the research reported upon emanates from a quantitative study that was underpinned by the review of related literature. A survey was conducted among general contractor (GC) members of the South African Federation of Civil Engineering Contractors (SAFCEC), consulting engineer members of Consulting Engineers South Africa (CESA) and selected public sector clients.

Based on inferential statistics, selected findings show that inconsistent and inadequate risk allocation and management practices could lead to inappropriate choice of procurement strategy. Inadequate documentation and transfer of experience and performance could also result in limited organisational knowledge, learning and transfer. The lack of delivery management skills within public sector establishments could result in poor execution of projects, and an inappropriate organisational culture among project partners may lead to resistance to the changes that are necessary for inculcating performance improvement.

Although these aforementioned perceptions pertain to a limited number of respondents, especially the individuals working for the clients in the public sector, their views are insightful. As most of the participants were generally involved in public sector construction projects, their opinions can point to a way forward.

BACKGROUND

An empirical study that examined the performance of infrastructure projects funded by the Asia Development Bank (ADB) in four Asian developing countries (China, India, Thailand and Bangladesh) revealed that most of those projects experienced schedule delays and cost under runs (Ahsan & Gunawan 2010: 77). Cost under runs in this context refers to when projects are completed under the budget. In other words, allocated money is unused and accounted for as a surplus. Project scope reduction, design changes, local taxes and changes in the policies of interested parties were cited by the authors as causes of cost under runs, amongst others. The major causes of project delay were attributed to issues related to procurement, civil works, land acquisition, consultant recruitment, natural calamities and host country government procedures. The study findings observed that procurement is one of the biggest challenges encountered on the projects. Delays in procurement are often caused by long bid evaluation times, operational delays by implementing organisations, and inexperience of local authorities supervising the projects. In fact, the authors noted that in the countries studied, governmental bureaucratic problems include a slow decision-making process and policy changes (Ahsan & Gunawan 2010: 75). For example, out of the 73 projects examined, contract evaluation and award emerged as the major cause of delays on 43 projects.

The findings of this study are not isolated. Rather, a number of publications have continually beamed the searchlight on project performance, especially in a developing country such as South Africa. For instance, though the activities of the South African Construction Industry Development Board (CIDB) have had some impact on the construction industry's performance, a recent review of literature suggests that more should be done, as the performance is not improving as expected (Emuze & Smallwood 2011: 112). In particular it was argued that major scope for contractor development and improvement in performance related to construction schedule, construction health and safety (H&S), quality and payment of

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contractors exists in South Africa. Therefore, the overall research aim and objective of this discourse is underpinned by the need to improve project performance in South Africa.

The research objectives include:

- The assessment of performance improvement management strategies.
- The recommendation of robust ways that these management concepts can be used to improve performance in South Africa.

Pursuant to the realisation of these objectives, eight hypotheses were formulated based on known management strategies in the construction management research (CMR) domain (see Emuze 2012: 8–13). The use and/or promotion of these management concepts could address some of the project-related problems that manifest as rework, defect and even disputes among project parties. As an illustration, while the performance of client bodies related to documentation, procurement and the management of variation order is reportedly poor (Marx 2009: 564), contractors and consultants are deemed to struggle to produce quality services and products in the sector (CIDB 2004). The hypotheses pertaining to this paper, which mostly address strategic issues, include:

- Inconsistent and inadequate risk allocation and management practices lead to inappropriate choice of procurement strategy in the public sector.
- Inadequate documentation and transfer of experience and performance result in low organisational knowledge, learning, and transfer.
- The lack of infrastructure delivery management skills within the public sector results in poor implementation of construction procurement strategies.
- Inappropriate organisational culture among project partners leads to resistance to change and innovation in the construction supply chain.

It should be noted that the postulated hypotheses were formulated in order to examine certain variables in terms of cause and effect. The cause and effect indicated by the hypotheses are therefore not sacrosanct, as disparity between project environment and characteristics often lead to other factors that may result in similar consequences.

LITERATURE REVIEW

The argument that the implementation of selected management programmes or strategies can engender improvement in production environments was strengthened by a recent article. The article presented the findings of a study that focused on the productivity of construction crafts. Using management strategies such as pre-planning, team building, automation and integration of information systems, and health and safety (H&S) to evaluate 41 projects in terms of productivity, Shan *et al* (2011: 311–314) discovered that management programmes had a positive correlation with improved mechanical construction productivity.

In furtherance of this principle, a number of management strategies such as risk management (RM), knowledge management (KM), skills improvement and organisational culture have been said to be beneficial to performance improvement in construction (Smith *et al* 2006: 4; Quintas 2005: 12; Lawless 2007: 150; Sommerville & Craig 2006: 47).

Risk management

When managing risk, decisions are made against a predetermined set of objectives, rules or priorities based on knowledge, data and information relevant to an issue. Smith *et al* (2006: 3 and 2006: 4) contend that risk exists when a decision is expressed in terms of a range of possible outcomes, and when known probabilities can be attached to the outcomes; and uncertainty exists when there is more than one possible outcome of a course of action, but the probability of each outcome is not known. An intelligent client should therefore be able to address these risk types before a procurement strategy is chosen. Though clients often have an overall risk management strategy and policy, some of them fail to see that the principal issues concerning how risk exposure and transfer are dealt with determine how well a procurement strategy performs.

For instance, a recent South African study observed that South African contractors consider themselves to be exposed to risks caused by and imposed by employers; and the management of employer risks has positive benefits for contractors, as costs are managed and profits maximised (Rwelamila & Jerling 2011: 61). In effect, the study concluded that employer-generated risks have significant impact on the outcome of construction projects, and the risks can be identified and managed (Rwelamila & Jerling 2011: 62).

Knowledge management

Knowledge management (KM) can be viewed as a systematic process of discovering, choosing, arranging, refining and presenting information in such a way that it improves an employee's comprehension relative to a specific area of interest (Sommerville & Craig 2006: 61). In other words, KM is the discipline of creating a flourishing work and learning environment that fosters the continuous creation, aggregation, use and re-use of both organisational and personal knowledge in the pursuit of new business values (Cross 1998 cited by Quintas 2005: 12).

This process and action-oriented description of KM indicates that it may be applicable to the improvement of the construction process. The high levels of service inputs characterised by professional knowledge or expertise relative to a specific technical or functional domain may qualify the industry as a knowledge-intensive industry. In fact, documented research findings indicate that design, architecture, surveying and other construction services are knowledge-intensive service sectors (Egbu & Robinson 2005: 33).

To this end, a developing country (Malaysia) examined the integration of KM processes into site management practices in the Malaysian construction industry (Mohamed *et al* 2011: 312). The study identified two key benefits of the framework for integrating KM into site management practices. Firstly, the framework enabled the availability of past solutions and standard procedures for problem-solving purposes. Secondly, the designed framework can increase the ability of the site manager to learn from the environment and to incorporate the knowledge into site management practices. In other words, the KM process can assist site managers to reduce the number of problems that occur and minimise the negative impact of unpredictable problems (Mohamed *et al* 2011: 312).

Skills development

Highly skilled individuals and competent teams that consist of clients, designers, suppliers and contractors are important for the construction process. Standard construction requires individuals with basic knowledge and skills. However, problem-solving people are required for innovative infrastructural projects that are often ill-defined and complex to implement. Therefore, individuals with tacit knowledge are central to the creativity required in the design and construction of innovative projects (Egbu & Robinson 2005: 38).

Lawless (2007: 50) contends that the total number of civil engineers employed in the public sector is so inadequate that technical and project management support necessary for developing road networks and other major projects may become highly difficult to come by in South Africa. Apart from service delivery challenges, the shortage of skills has resulted in loss of institutional knowledge, uncoordinated housing developments,

and endangers the performance of projects (Lawless 2007: 125–150).

Organisational culture

According to the results of the investigation conducted by Girmscheid & Hartmann (2002: 380), innovative potential that is created by procurement strategy can only be used if the organisational culture of construction firms is open to performance improvement.

However, it has been argued that the present nature and structure of the industry indicates that many processes are replicated so much that non-value-adding activities and inefficiencies are propagated unabatedly (Han *et al* 2007: 2088). Therefore, in order for the industry to improve its performance, the industry needs to change its prevailing culture, and by implication, supply-chain member firms need to change their culture towards a culture that supports continuous improvement. The evolution of appropriate organisational culture will not only allow information sharing between projects and teams, and across organisational boundaries, but will also support the construction sector in adopting new processes, which improve quality and productivity (Sommerville & Craig 2006: 47).

THE RESEARCH

Because of the exploratory nature of the study, the research method adopted the use of structured questionnaires. The questionnaires were generated primarily from issues dealing with project management outcomes. Further, the descriptive method was used in this research. According to Leedy & Ormond (2005: 179), the descriptive survey method is employed to process data obtained through observation. The survey was designed with close-ended questions and one open-ended question. Respondents were able to identify performance impediments using a five-point scale: (1) minor extent, (2) near minor extent, (3) some extent, (4) near major extent, and (5) major extent. Furthermore, in order to score the effects of the impediments, respondents were provided with a five-point scale: (1) totally disagree, (2) disagree, (3) neutral, (4) agree, and (5) totally agree. In all instances where a likert-scale type of question was used, an 'unsure' option was provided for the respondents.

One hundred and fifty-four (154) individuals working for clients, consultants and general contracting organisations constituted the sample size. The selected clients were public works officials at provincial and national departments responsible for public sector projects. The consultants were civil engineering consulting engineers who were members of CESA, while the general contractors were members of SAFCEC. Instead of the random sampling method, the purposive method was used for compiling the sample size. Purposive sampling is a procedure in which the research samples whoever is believed by the researcher to be representative of a given population group (Springer 2010: 107). The difference between purposive and probability sampling approaches is that purposive sampling is based on the researcher's informal ideas about representativeness. Although probability sampling is clearly preferable to purposive sampling, the latter is often used when population characteristics cannot be precisely determined (Springer 2010: 107). After the survey period, which spanned eleven weeks, only fifty-four (54) validly completed questionnaires were returned, and included in the analysis of the data, which equates to a response rate of 35.1% (Table 1).

Table 1 Survey response rate

Respondent group	Sample size (No)	Response (No)	Response rate (%)
Public sector clients	42	11	26.2
Members of SAFCEC	56	15	26.8
Members of CESA	56	28	50.0
Total	154	54	35.1

INTERPRETATION OF THE RESULTS

The inferential statistics related to the hypotheses involved Cronbach's alpha internal reliability test, average inter-item correlation, and the test of means against reference constant. Cronbach's alpha is used for combining items in likert-type scales that use each individual item to measure a phenomenon that has an underlying quantitative measurement continuum (Gliem & Gliem 2003: 82).

The closer Cronbach's alpha is to 1.0, the greater the internal consistency of the items in the scale, that is, the higher the alpha coefficient, the more reliable the test (Gliem & Gliem 2003: 87). In brief, George & Mallery (2003: 231) provide the following rules of thumb: > .9 is excellent, > .8 is good, > .7 is acceptable, > .6 is questionable, > .5 is poor, and < .5 is unacceptable for interpreting Cronbach's alpha coefficients.

In addition, while empirical research usually aims to compare groups or relationships between variables, a statistical test is performed to see whether the observed difference or relationship between variables is statistically significant. This significance is often the result of testing a null hypothesis against an alternative hypothesis with the aim of producing a p-value as part of the output. In this context, the null hypothesis is a statement that the parameter takes a particular value, which represents no effect, while the alternative hypothesis states that the parameter falls in some alternative range of values, which represents an effect of some type (Agresti & Franklin 2007: 369). This statistical significance, however, only means that the probability of rejecting the null hypothesis when it is true is very small (less than 0.05) without providing information about the size and practical importance of the difference or relationship between the variables, in spite of the fact that Cohen (1990 cited by LeCroy & Krysik 2007: 243) argued that the primary product of a research inquiry is one of measures of effect size as opposed to measures of p values.

Effect size thus refers to a metric that estimates the size of a treatment effect (Meline & Wang 2004: 204). LeCroy & Krysik (2007: 243) contend that measures of effect size provide critically different information from alpha levels, as they address the practical importance of the results through the assessment of the magnitude of the effect. Nevertheless, it is advisable that effect size interpretations should not be void of measurement considerations, such as score reliability (LeCroy & Krysik 2007: 244), and therefore reliability tables and test of means against reference constant tables are provided to support the test of each hypothesis. Though there are other effect size measures, the standardised mean difference known as Cohen's d is used. According to LeCroy & Krysik (2007: 245) and Meline & Wang (2004: 205), Cohen's d is the commonest method used for reporting effect sizes; and the interpretation of their values range between small effect size (≤ 0.35), medium effect size (≤ 0.65) and large effect size (> 0.65). In brief, in terms of this particular study:

- the null hypothesis is H_0: $p = 3$, and
- the alternative hypothesis is H_1: $p > 3$.

THE RESULTS

Hypothesis 1

The questions that were asked in this section stem from the assumption that the existence of risk, and whether it should be retained,

avoided or transferred, is very much at the centre of all procurement strategies (Jaggar *et al* 2002: 181). And it is important that an intelligent client should be able to address project risks before a procurement strategy is chosen. In effect, if risks can be transferred, then their impact can be shared or totally carried out by another party in the construction supply chain. Although risks cannot be totally eliminated through contracts, a chosen strategy can influence their management effectively (Smith *et al* 2006: 139). Though the choice of contract, and hence risk allocation strategy, is determined by the policy decisions of the client and specific project requirements when policy considerations take precedence over specific project requirements, it is important that clients remember that inappropriate strategy on the retention or distribution of risks could jeopardise projects (Bower 2003: 18). To this end Table 2 suggests that the individual mean score (MS) of the variables relative to risk allocation strategies can be safely combined into a single mean with a good internal reliability of 0.84, and the variables can also be deemed to be properly correlated with average inter-item correlation of 0.60. Table 3 suggests that the individual MSs of the variables relative to procurement criteria can be safely combined into a single mean with a good internal reliability of 0.80, and the variables can also be deemed to be properly correlated with an average inter-item correlation of 0.58. Table 4 suggests that the individual MSs of the variables relative to misallocation of project risks can be safely combined into a single mean with a questionable internal reliability of 0.66, and the variables can also be deemed correlated with an average inter-item correlation of 0.31.

Therefore, Table 5 presents the test of means against reference constant relative to the hypothesis. It is notable that for all such tables, the mean is the combined mean score of variables relative to the question, Std Dv is the standard deviation for the mean, number is the number of valid responses relative to the question, RC is the reference constant, t-value is the single tail test statistics, df is the difference in number, the *p*-value is the probability that the test statistics equal the observed value, and Cohen's d is the effect size value and ranges. Therefore, based on the statistics in Table 5, it can be assumed that:

- In terms of variables in Table 2, the mean is not significantly greater than the reference constant, hence H_0 cannot be rejected and H_1 also cannot be accepted.
- In terms of variables in Table 3, the mean is not significantly greater than the reference constant, hence H_0 cannot be rejected and H_1 also cannot be accepted.
- In terms of variables in Table 4, the mean is significantly greater than the reference constant, hence H_0 can be deemed rejected, while H_1 can be deemed accepted.

However, the Cohen's d effect size measure indicates that, although the significant test statistics for questions that are indicated in Tables 2 and 3 are not so favourable, the result has a medium effect size with Cohen's d values of 0.44 and 0.60 respectively. It is equally notable that the results for questions related to misallocation of risks (Table 4) have large effect size measures with Cohen's d value of 0.80. In other words, in spite of the statistical test non-significance status of variables in Tables 2 and 3, all the results relative to this particular hypothesis are of medium and large practical importance. Therefore, in practical terms:

H_0 = Inconsistent and inadequate risk allocation and management practices do not lead to inappropriate choice of procurement strategy in the public sector.

Table 2 Reliability for risk allocation strategies

Strategies	Valid N	MS	Std Dv	Rank
Identification of risk avoidance/prevention measures	11	4.09	1.2	1
Considerations relative to contract pricing strategies	11	3.91	1.1	2
Cost of risk transferred to project partners	11	3.55	1.7	3
Establishment of contingency plans	11	3.09	1.3	4
Incentives to improve project performance	10	2.70	1.8	5
Cronbach alpha: 0.84				
Average inter-item correlation: 0.60				

Table 3 Reliability for procurement criteria

Criteria	Valid N	MS	Std Dv	Rank
Design responsibility and accountability	11	4.00	1.5	1
Project certainty relative to cost, quality and time	11	3.82	1.3	2
Legislation relative to preferential procurement (BEE)	11	3.82	1.5	3
Project complexity relative to constructability	11	3.55	1.5	4
Attitudes to risk transfer	10	3.00	1.5	5
Cronbach alpha: 0.80				
Average inter-item correlation: 0.58				

Table 4 Reliability for misallocation of project risks

Situations	Valid N	MS	Std Dv	Rank
Delay in project completion	37	3.86	0.9	1
Increased total project cost	37	3.84	1.0	2
Delay in award of the tender	36	3.64	1.4	3
Likelihood of disputes between project partners	37	3.43	1.1	4
High amount devoted to contingency plans	37	3.19	1.1	5
Cronbach alpha: 0.66				
Average inter-item correlation: 0.31				

Table 5 Test of means against reference constant relative to Hypothesis 1

	Mean	Std Dv	Number	RC	t-value	df	*p*-value	Cohen's d	
Table 2	3.48	1.10	11	3	1.46	10	0.17558	0.44	M
Table 3	3.66	1.09	11	3	2.00	10	0.07378	0.60	M
Table 4	3.59	0.73	37	3	4.87	36	0.00002	0.80	L

Table 6 Reliability for inadequate documentation and transfer of knowledge

Practices / Situations	Valid N	MS	Std Dv	Rank
Poor information management	54	3.74	1.1	1
Lack of mentorship programmes	53	3.53	1.0	2
Poor allocation of resources to knowledge capture	51	3.51	1.1	3
Lack of post-project reviews / reports	53	3.49	1.2	4
Lack of detailed databases relative to past projects	54	3.39	1.1	5
Cronbach alpha: 0.81				
Average inter-item correlation: 0.47				

Table 7 Reliability for effect of improper records and transfer of knowledge

Situations	Valid N	MS	Std Dv	Rank
Inability to tackle risks / uncertainties effectively	53	3.68	1.1	1
Inability to disseminate 'best practices'	53	3.68	1.1	2
Repetition of past project mistakes	53	3.64	1.1	3
Inability to innovate and respond to clients' needs	52	3.63	1.0	4
Ineffective problem-solving capabilities	54	3.59	1.2	5
Lost opportunities to improve project performance	52	3.58	1.1	6
Poor response to organisational and project changes	52	3.56	1.1	7
Loss of contractor, subcontractor / supplier track record	53	3.29	1.2	8
Cronbach alpha: 0.92				
Average inter-item correlation: 0.59				

Table 8 Test of means against reference constant relative to Hypothesis 2

	Mean	Std Dv	Number	RC	t-value	df	*p*-value	Cohen's d	
Table 6	3.54	0.83	54	3	4.77	53	0.00001	0.65	M
Table 7	3.57	0.91	54	3	4.60	53	0.00003	0.63	M

H_1 = Inconsistent and inadequate risk allocation and management practices lead to inappropriate choice of procurement strategy in the public sector.

Consequently, Table 5 indicates that inconsistent and inadequate risk allocation and management practices may indeed lead to inappropriate choice of procurement strategy in South African public sector departments responsible for the delivery of infrastructure and services.

Hypothesis 2

The motivation for the questions that pertain to this hypothesis came about based on the view that within an organisation, KM may even have the same degree of importance as labour, plant and materials (Fernie *et al* 2003 cited by Sommerville & Craig 2006: 62). This is because construction knowledge is created through the actions of individuals, project teams, organisations and the interactions between tacit and explicit knowledge in the project life cycle, which facilitate decision-making in the implementation of projects (Egbu & Robinson 2005: 35-36). Thus, Table 6 suggests that the individual mean scores of the variables relative to inadequate documentation and transfer of knowledge can be safely combined into a single mean with a good internal reliability of 0.81, and the variables can also be deemed to be correlated with average inter-item correlation of 0.47.

Table 7 suggests that the individual MSs of the variables relative to risk allocation strategies can be safely combined into a single mean with an excellent internal reliability of 0.92, and the variables can also be deemed to be properly correlated with average inter-item correlation of 0.59.

Hence, based on the statistics in Table 8, it can be assumed that for Hypothesis 2:

- In terms of variables in Table 6, the mean is significantly greater than the reference constant, hence H_0 can be deemed rejected, while H_1 can be deemed accepted.
- In terms of variables in Table 7, the mean is significantly greater than the reference constant, hence H_0 can be deemed rejected, while H_1 can be deemed accepted.

It is equally notable that the results for questions shown in Tables 6 and 7 have medium effect size measures with Cohen's d value of 0.65 and 0.63 respectively. In other words, all the results relative to Hypothesis 2 are of medium practical importance. Therefore, in practical terms:

H_0 = Inadequate documentation and transfer of experiences and performance do not result in low organisational knowledge, learning and transfer.

H_1 = Inadequate documentation and transfer of experiences and performance result in low organisational knowledge, learning, and transfer.

As a result, the findings suggest that inadequate documentation and transfer of experiences and performance may actually result in low organisational knowledge, learning and transfer.

Hypothesis 3

In order to evaluate this hypothesis, skills-related South African literature was examined. For instance, a number of reports in South Africa indicate that the industry suffers from skills shortages that affect the capacity of the industry and the public sector clients in terms of project delivery (CIDB 2007: 3). The differing levels of skills (among technicians, artisans and so on) in the industry directly result in poor performance concerning project cost, H&S, quality and time. Table 9 suggests that the individual MSs of the variables relative to skills shortages in public sector departments which are responsible for project delivery can be safely combined into a single mean with a good internal reliability of 0.83, and the variables can also be deemed correlated with average inter-item correlation of 0.41. In effect, based on the statistics in Table 10, it can be assumed that for Hypothesis 3 in terms of questions in Table 9, the mean is significantly greater than the reference constant, hence H_0 can be deemed rejected, while H_1 can be deemed accepted. It is notable that these results have large effect size with Cohen's d value of 1.00. In other words, the results relative to Hypothesis 3 are of large practical importance. Therefore, in practical terms:

H_0 = The lack of infrastructure delivery management skills within the public sector does not result in poor implementation of construction procurement strategies.

H_1 = The lack of infrastructure delivery management skills within the public

sector results in poor implementation of construction procurement strategies.

Consequently, Table 10 suggests that the lack of infrastructure delivery management skills within the public sector may indeed result in poor implementation of construction procurement.

Hypothesis 4

Girmscheid & Hartman (2002: 373) suggest that organisational culture which fosters performance improvement is highlighted through a high status of innovation, creativity, openness to risk treatments and willingness to tolerate mistakes, as well as an open multi-directional communication in an organisation. In other words, the benefits of organisational culture as indicated in the literature motivated the questions that were asked in this section. Table 11 suggests that the individual MSs of the variables relative to inappropriate organisational culture can be safely combined into a single mean with an excellent internal reliability of 0.90, and the variables can also be deemed to be properly correlated with average inter-item correlation of 0.60. Table 12 suggests that the individual MSs of the variables relative to the effect of inappropriate organisational culture can be safely combined into a single mean with a good internal reliability of 0.87, and the variables can also be deemed correlated with average inter-item correlation of 0.46.

As indicated in Table 13, it can be assumed that for Hypothesis 4:

- In terms of variables in Table 11, the mean is significantly greater than the reference constant, hence H_0 can be deemed rejected, while H_1 can be deemed accepted.
- In terms of variables in Table 12, the mean is significantly greater than the reference constant, hence H_0 can be deemed rejected, while H_1 can be deemed accepted.

In addition, it is notable that the results shown in Tables 11 and 12 have medium effect size measures with Cohen's d value of 0.47 and 0.45 respectively. In other words, all the results relative to Hypothesis 4 are of medium practical importance. In essence, in practical terms:

H_0 = Inappropriate organisational culture among project partners does not lead to resistance to change and innovation in the construction supply chain.

H_1 = Inappropriate organisational culture among project partners leads to resistance to change and innovation in the construction supply chain.

Table 9 Reliability for skills shortages in public sector

Situations	Valid N	MS	Std Dv	Rank
Decision-making relative to procurement strategy	26	4.23	0.8	1
Delay in payments relative to executed tasks	28	4.07	0.9	2
Poor establishment of what is to be procured	28	4.00	1.2	3
Poor implementation of procurement strategy	28	3.93	1.2	4
Increased total project cost	28	3.93	1.4	5
Unclear contract / procurement documentation	28	3.86	1.2	6
Delay in contract award after tender submission	28	3.79	1.3	7
Scope changes, claims and variations	28	3.57	1.4	8
Cronbach alpha: 0.83				
Average inter-item correlation: 0.41				

Table 10 Test of means against reference constant relative to Hypothesis 2

	Mean	Std Dv	Number	RC	t-value	df	*p*-value	Cohen's d	
Table 9	3.91	0.90	28	3	5.30	27	0.00001	1.00	L

Table 11 Reliability for inappropriate organisational culture

Practices	Valid N	MS	Std Dv	Rank
Poor analysis of issues and their impact	40	3.60	1.1	1
Lack of trust within project teams	42	3.52	1.3	2
Apathy towards idea generation and evaluation	39	3.38	1.3	3
Closed one-directional communication mediums	40	3.34	1.2	4
Non-inclusive decision-making within project teams	41	3.33	1.2	5
Improper worker motivation and empowerment	38	3.32	1.2	6
Cronbach alpha: 0.90				
Average inter-item correlation: 0.60				

Table 12 Reliability for effect of inappropriate organisational culture

Situations	Valid N	MS	Std Dv	Rank
Inadequate site relationship management	41	3.60	1.1	1
Poor problem identification and resolution	40	3.56	1.2	2
Poor harnessing of skills within project teams	40	3.43	1.2	3
Organisational stagnation / failure	39	3.41	1.3	4
Increased resistance to change	40	3.28	1.1	5
Customer / Client dissatisfaction	39	3.26	1.2	6
Employee dissatisfaction	41	3.23	1.2	7
Poor handling of social issues associated with projects	39	3.22	1.2	8
Cronbach alpha: 0.87				
Average inter-item correlation: 0.46				

Table 13 Test of means against reference constant relative to hypothesis 4

	Mean	Std Dv	Number	RC	t-value	df	*p*-value	Cohen's d	
Table 11	3.46	0.99	42	3	3.02	41	0.00430	0.47	M
Table 12	3.37	0.83	41	3	2.90	40	0.00600	0.45	M

The findings thus suggest that inappropriate organisational culture among project partners leads to resistance to change and innovation in the construction supply chain.

DISCUSSION

The descriptive statistics presented in Tables 2, 3 and 4 *inter alia* suggest that certain decisions contribute majorly to the choice of procurement strategy. These include:

- The identification of risk avoidance/prevention measures
- Considerations relative to contract pricing strategies
- Cost of risk transferred to project partners

In addition, the criteria deemed to be to the detriment of procurement strategy are not limited to:

- Design responsibility and accountability
- Project certainty relative to cost, quality and time
- Legislation relative to preferential procurement
- Project complexity relative to constructability

Furthermore, major consequences of misallocation of project risks, such as delay in project completion, increase in total project cost, delay in award of tenders and the possibility of disputes, amplify the need to change attitudes towards risk transfer.

According to Table 8, inadequate documentation and transfer of experience and performance may actually result in low organisational knowledge, learning and transfer in South Africa. In other words, failure to mentor new entrants into the industry, and also failure to learn from past mistakes and best performance do not augur well for the construction industry. The results presented in Table 10 corroborate the perception that the lack of infrastructure delivery management skills within the public sector may indeed result in poor implementation of construction projects (Lawless 2007). In particular, the consequences of skills shortages in public sector departments responsible for project delivery are multi-faceted, with decision-making relative to procurement strategy being affected the most.

With regard to Hypothesis 4, the organisational culture pertaining to clients, consultants, contractors and every other organisation involved in project realisation must be improved. In this sense, the study findings indicate that practices contributing to inappropriate organisational culture include poor analysis of issues and their impact, lack of trust within project teams, apathy towards idea generation and evaluation, closed one-directional communication mediums, non-inclusive decision-making within project teams, and improper worker motivation and empowerment.

Therefore, it is obvious that these practices, as well as their consequences, call for an appropriate organisational culture among project partners in South African construction.

RECOMMENDATIONS

Since the study results suggest that inappropriate choice of procurement strategy in the public sector may spring up a range of consequences, it is recommended that appropriate allocation and management of project risk should be prioritised when making decisions relative to the choice of procurement strategy. In particular, it is suggested that decisions related to procurement of public sector projects should be underpinned by robust risk assessment and management processes, especially at project inception. While recognising the importance of legislation and regulations, public sector clients should endeavour to make use of the guidelines provided by the CIDB (2006) infrastructure delivery and procurement toolkit before choosing a procurement strategy. Risk transfer process and procurement options are visibly addressed in the toolkit.

The findings of the study in terms of skills invariably amplify the need to ensure that only competent construction professionals are assigned construction implementation responsibilities. Public sector organisations should increase their capacity in speciality areas such as civil engineering and construction management, and new recruits into public sector departments should be mentored to ensure the appropriate transfer of knowledge by experienced professionals. Consultants can also improve the pool of available skills in the industry by ensuring that new technicians are exposed to design and site-related training (formal and informal). As documented in the literature, and as per this particular study, it is important to promote the appointment of experts and specialists into responsible public works positions in South Africa.

In addition, based on the research findings, it can be recommended that experience and best performance in the industry should be disseminated extensively for knowledge transfer purposes. For the good of the industry, best practice should not be consigned to organisational archives in the name of proprietary rights. Rather best practice and performance should be made known at industry-related conferences, workshops and seminars, and to related media. In other words, it is imperative that project stakeholders manage project information adequately, allocate adequate resources to knowledge capture, and also carry out post-project reviews.

The results relative to culture also suggest that the organisational culture within project teams must be improved in the South African construction environment. Top management in client, consultant and contracting firms should become 'agents of change' who engender a cultural shift in the industry. A transformational leadership approach that embraces innovation and creativity should be encouraged in the industry. Failure to engender a good organisational culture among project partners may marginalise projects in the form of inadequate site relationship management, poor problem identification and resolution, and poor harnessing of skills within project teams, or worse, organisational stagnation and/or failure.

While wholesome generalisation cannot be made based on the presented data, the views of the professionals that took part in the study can be considered to be of value in the South African context.

CONCLUSIONS

The performance of public sector projects (infrastructure) was addressed in this study based on perceived improvement opportunities that were identified in the construction management literature. Although performance improvement tools, such as lean construction, are making significant inroads into the sector to some extent, this study examined how contemporary management strategies, which are being promoted in developed countries, could be utilised in a developing country context.

Risk management, knowledge management, skills development and organisational culture thus formed the cornerstone of the discourse. The study indicates that there is major scope for the advancement of these management concepts in the South African infrastructure sector. While noting the limitation of the findings in terms of sample size, response rate, and the limited inputs from professionals employed by clients, it is important to argue that perceptions expressed by the respondents deserve further exploitation in South Africa. In essence, project performance which depends on the competence of, and the relationship between, stakeholders necessitates the use of one or all of the abovementioned concepts. The management strategies individually or collectively could contribute to performance improvement in construction.

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