Identification of Performance Measures for Municipal Construction Projects in Saudi Arabia

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ABSTRACT

This document gives formatting instructions for authors preparing papers for publication in the Recent Science Journals. The authors must follow the instructions given in the document for the papers to be published. You can use this document as both an instruction set and as a template into which you can type your own text. Performance measures are a key management tool that determine success or failure of performance whether at organizational or project level. In municipalities, performance measures are being utilised to attain stakeholders' and citizens' expectations concerning efficiency and effectiveness in delivery of infrastructure projects.

Providing public infrastructure in Saudi Arabia is the responsibility of Municipalities which currently have inadequate performance measures. The purpose of this paper is to identify various objective and subjective performance measures to introduce a performance measurement framework. To commence the basic requirement and to fulfil the main objective of this research work, basic data were collected based on survey questionnaires. It is a 10 page structured questionnaire, targeted towards three groups in Saudi Arabia ' s construction industry (Contractors, Government officials and Consultants). The results reveal that performance measures currently in use revolve around old fashioned measures of the project triangle, viz. cost, time and quality. This research also concludes that other aspects of measurement, such as satisfaction, management and strategy, project production and business performance, are seen as less important measures for construction project performance. However, according to researchers they are considered as significant measures which need to be taken into consideration.

Keywords-Performance measures, Construction projects, Project performance, Municipality, Saudi Arabia

1. INTRODUCTION

Over recent decades, researchers have consistently agreed and have consensus regarding the significance of the construction sector and its influence on a country's economy, despite it having an unstable and uncertain nature (Chan & Chan, 2004). To achieve economic development, measurable objectives must be set and then used to determine the targets, performance measures and critical success factors. In the same context, the agenda in the construction industry must be reconsidered to include efficiency and effectiveness of construction projects (Egan, 1998). Previous studies that focused on performance in the construction sector concluded that there is poor performance with regards to achieving goals and the expectations of stakeholders, and that weaknesses are due to the fact that the project is handled traditionally, whereby the focus has been on product and goals only, whilst, the concept has shifted from being merely product-oriented to process-based (Haponava & Al-Jibouri, 2010).

In relation to this, the construction industry in Saudi Arabia is not excluded from the global failure being suffered in construction performance (Al-Otaibi & Price, 2009). Research conducted in the construction industry has concluded that poor performance is a consequence of concentrating on achieving desired goals and delivered project (Haponava & Al-Jibouri, 2010). It is suggested that

to accomplish better performance a comprehensive measurement framework should be adopted, taking stakeholder perspectives into consideration (Lehtiranta, Kärnä, Junnonen, & Julin, 2012). Developing such systems would require setting the measurable targets and performance measures throughout the project life and across various stakeholders (Takim & Akintoye, 2002). Thus, the intention of writing this paper is to identify performance measures for public construction projects particularly in municipalities over the project lifecycle. Accordingly, data regarding practitioners' opinions was gathered by distributing questionnaires to Government Officials as owner, contractors and consultants who work on municipal projects in Saudi Arabia.

2. EXISTING PERFORMANCE MEASURES

Performance measurement is being applied as a key management tool that determines success or failure of performance whether organizationally or functionally and implemented as a means to providing answers to three key questions: *''How well is an organization performing? Is the organization achieving its objectives? How much has the organization improved from a last period?''* (Phusavat, Anussornnitisarn, Helo, & Dwight, 2009). Beatham et al (2004) mentioned that performance measurement has been conducted by managers who *''want to know where there are and what they have to improve; or they want to influence their subordinate's behaviour''*. Generally, managers utilize performance measurement to gain quantitative and qualitative data to improve performance by decision making (Phusavat, Anussornnitisarn, Helo, & Dwight, 2009). However, public managers have been applying performance measurement for managerial purposes, these being to evaluate, control, budget, motivate, promote, celebrate, learn and improve (Behn, 2003). By contrast, performance measurement systems (PMS) are widely applied in the business sectors (Edwards & Thomas, 2005). Enoma et al (2007) reveal that the purpose of measurement is to enable the organisation to construct comprehensive improvement strategies that involve *''planning and control, continuous improvement, resource allocation, motivation and long-term focus judging it''*

Historically, according to Greiling (2005) the concept of measuring performance first appeared during the 1940s in the New York Bureau of Municipal Research as a budgetary system. Since that time, succession, expansion and development of the concept took place through the 1960s, during 1970s and 1980s where zero-based budgeting systems were used, and it became a key topic in the public sector in the 1980s and 1990s. (Nudurupati, Arshad, &Turner, 2007). Performance measurement was launched in the 1970s by the accounting sector, where financial indicators (lagging indicators) were applied. Since then, many systems and frameworks have emerged and developed to include non-financial indicators (subjective indicators) such as quality, customer satisfaction and innovation in these systems, for example BSC and KPIs. The concept of a performance measurement system has been directed and improved in three generations; the first generation was designed to measure financial dimensions, which were criticised for not integrating performance measures. The second generation of measurement systems was created to address the weaknesses of the first by taking into consideration strategies and success factors and deploying them in the process. The third generation would be developed to link financial and non-financial dimensions to the concept of cash flow (Neely, Marr, Roos, Pike, & Gupta, 2003).

Over the years, performance measurement has been subjected to various attempts and movements to encourage improvement, increase accountability and transparency, support decision making and improve management practices. Despite these attempts, the performance measurement systems are still under improvement in developing countries. According to previous research, numerous attempts to measure public agency have been practised. These experiences were conducted in the municipal sector and these are: The Atlanta Scorecard, which pays attention to the final results as opposed to the operation process (Edwards & Thomas, 2005). Performance Management Analysis (PMA) Dutch Municipality "Lelystad, Performance-Driven", a program which was launched by Lelystad municipality concerned with performance management and its implementation created performance indicators to enhance financial accountability through an objectives-led programme budget (de Waal & Gerritsen-Medema, 2006). Municipal Performance Measurement Program (MPMP), which is a measurement tool launched in 2000 by Ontario municipalities considering two factors in its measures, firstly *efficiency* including the use of the current resources compared with its outcomes of services according to the costs. The second factor is *effectiveness* which points out the outcomes of the services in relation to its targets (Burke, 2005). York City Council in the UK initiated a performance review framework, not merely focused on *"economy, efficiency and effectiveness"* or *"input, output and outcome''*, but also emphasizing *''consumer satisfaction, quality and community/market impact as well as efficiency in production of services''* (Bracegirdle, 2003). The Philippines LGU Measurement System is a practical, working example of the logic model, the LGU measurement system implemented by the Philippine government combining three elements: resources, framework and process of execution; quality and quantity of services provided; final results which affect the environment surrounding the citizens to create a healthy environment suitable for life (Bracegirdle, 2003).

Measurement systems have the potential to enhance and support the municipalities' ability and service quality in three main areas: result management, customer service and communications (Bracegirdle, 2003). Moreover, performance measurement has a very important role in the improvement of the coordination and communication process among the different municipals in local authorities and decisions making as well (Melkers & Willoughby, 2005). This is clarified in the report conducted by

Governmental Accounting Standards Board whereby 80% of city and county governments using performance measures which were covered by the survey in U.S. benefitted from the measures stating that they enable a more concentrated approach to their objectives and improve their awareness regarding the key factors which impact on their achievement of those objectives, in addition to increasing quality and communications among partners. Nevertheless, duplication and inefficiency have not been crucially impacted upon in municipalities (Bracegirdle, 2003).

3. MEASURING MUNICIPAL CONSTRUCTION PROJECT PERFORMANCE

The construction industry is undoubtedly a vital component (Othman, Torrance, & Hamid, 2006) (OECD, 2010) and thus, it is deemed as the backbone and the main driver of the other economic sectors in many countries, whether developed or which are still developing (Aibinu & Jagboro, 2002) where it represents, for example 6-10% GDP (Wibowo, 2009). Most of the projects delivered by the construction sector are considered public service, such as infrastructure which are owned by government agencies and the municipalities in particular, as in Saudi Arabia (Al-Khalil & Al-Ghafly, 1999), as well as non-profitable projects (Behn, 2003). Numerous projects are produced and provided by the construction industry in both the public and private sectors with the most significant projects owned by the government: infrastructure and public facilities such as hospitals, schools and other airports. (Othman,Torrance, & Hamid, 2006).

In contrast, generally in the construction industry the three basic criteria which are cost, time and quality are widely applied to determine project success (Eriksson & Westerberg, 2011) (Toor & Ogunlana, 2010) (Haponava & Al-Jibouri, 2009) (Yang, Yeung, Chan, Chiang, & Chan, 2010) (Othman, Torrance, & Hamid, 2006) (Long, Ogunlana, Quang, & Lam, 2004). However, the success concept for public construction projects as stated in previous research conducted in South Africa, there are six dimensions, these being economy, environment, society, resource utilisation and project management to measure infrastructure project success (Ugwu & Haupt, 2007), whilst in Malaysia public construction project success metrics are determined from a macro view (Othman, Torrance, & Hamid, 2006). Others concluded that the design of successful performance measurement systems to measure construction project success must be built on dividing the project into phases and that performance measures be determined according to stakeholders' perspectives (Takim, Akintoye, & Kelly, 2003) (Takim & Akintoye, 2002).

According to Edward & Thomas (2005) citizens have two aspects of concern in terms of municipal service delivered, which are efficiency and effectiveness of projects and, as such, to achieve user satisfaction, their expectation, need and what they want must be considered (Folz, 2004). Swindell & Kelly (2002) defined citizens' perception toward success of public projects as subjective data and project data as objective. However, the author was concerned with reliability of data collected through surveys to investigate to what extent citizens were satisfied regarding government projects.

4. BACKGROUND ON PROJECT PERFORMANCE IN SAUDI ARABIA

Public construction projects in KSA represent the core of the construction sector with projects such as public buildings, roads, bridges, water engineering infrastructure, domestic and recreational facilities (Al Shaikh & Chahine, 2011). However, the KSA construction sector is experiencing growth and development in comparison to developed countries. In 2010, the Saudi construction industry grew by a ratio exceeding 6.1% with a value of US$21bn. The KSA economy has experienced growth as a result of an increase in the global demand for oil (Al-Sedairy, 2001). However, this growth is expected to maintain and continue with average progress around 4% until 2015. The construction industry in Saudi Arabia is still under development and growth, and this growth in the Saudi economy is a result of the increase in global demand for oil, which has caused prices to increase rapidly and thus increase the annual revenue of the state. The construction sector has also been impacted by this economic growth (Al-Sedairy, 2001). However, the Saudi construction sector is suffering from the absence of a framework for measuring and evaluating the performance of projects in the public and private sector (Al-Otaibi & Price, 2009). One of the most significant problems facing the progress of construction projects in developing countries is the lack of consideration and planning of projects in the pre-implementation stage, as well as failure of projects during their execution. As a result the desired goals are neither achieved nor integrated with the general developmental or economic strategy in the country (Al-Hammad, 1995). Whilst there is also a lack of methodology and mechanisms to monitor and control projects, as is the case in developed countries, some research has been done by developed countries regarding how to control and measure the performance of construction projects in the public and private sectors (Haponava & Al-Jibouri, 2009) (Beatham, Anumba, & Thorpe, 2004) (Chan & Chan, 2004) (Ankrah & Proverbs, 2005). It is essential therefore that these are investigated and studied to select the suitable methods and the appropriate mechanisms in order to apply them to address poor performance in construction projects in Saudi Arabia. However, a new system of performance measurement is anticipated to address and remedy these issues within the construction industry involving institutional aims, plans, goals and strategies.

5. RESEARCH METHODS

This study is conducted as a fundamental component of PhD research aimed towards introducing a performance measurement model for construction projects in municipalities in Saudi Arabia. In most previous studies, quantitative approaches particularly questionnaires have

been applied as a common and appropriate way to identify performance measures. Different authors have investigated and gathered primary data for their studies by utilising a questionnaire approach (Doloi & Lim, 2007) (Lehtiranta, Kärnä, Junnonen, & Julin, 2012) (Yang & Peng, 2008) (Toor & Ogunlana, 2010) (Ugwu & Haupt, 2007) (Lin, Sun, & Kelly, 2011) (Abd Elshakour , Al-Sulaihi, & Al-Gahtani, 2012) (Othman, Torrance, & Hamid, 2006). In this current study the primary data was collected by sending questionnaires to three groups of key players involved in municipal projects in Saudi Arabia, namely municipal engineers as an owner, consultant and contractor. The respondents in this study were professionally placed at the managerial level or higher, and these respondents hold experience in project management and also work as project managers.

The questionnaires were designed based on a literature review to the related studies on performance measures whether in developed or developing countries and comprised of six sections. In the second section which belongs to this research and is going to be reported here, the respondents were asked to give their opinion by assessing the significance of performance measures for three basic construction project stages which are conceptual, planning and tendering stage, production stage and operation stage according to seven-point Likert-type scale (where 1= not important, 2 = slightly important, 3= somewhat important, 4= moderately important, 5= important, 6= very important and 7= extremely important) during three construction project stages). The participates' responses had been analysed using SPSS to identify the means for each measure, as well as ANOVA testing to discover the significance between the three groups in three project stages.

6. STATISTICAL ANALYSIS

After going over the detailed literature review, it was possible to identify 77 important measures. Identified measures focused on non-profit construction projects such as government projects that deliver as public service to citizens with municipal responsibility in Saudi Arabia during three project stages. These stages are ''conceptual, planning and tendering, production and operation stage'', that were given to participants representing key stakeholders: government officials, consultants and contractors.

They were asked to mark down their opinion in terms of significance of performance measures levels, critically, of Saudi's construction projects on a 7-point Likert scale. The continuum has a 1 to 7 ranking scale, going from 1 'not important' to 7 'extremely important'. Additionally, to examine the variance between the mean values of all the participants ANOVA testing was undertaken. All of the questions were closed rather than open-ended in nature so that the respondents could easily understand and answer them, thereby bringing an improvement in response rating. Analysis of results was done by using SPSS software.

6.1 Measures of Conceptual, Planning and Tendering Stage

Table 1 shows the list of 14 variables for performance measures for conceptual, planning and tendering stage. Ranking of the total mean scores was done on their importance levels. From these 14 variables, 8 of them were ranked by the groups to be 'extremely important'. For the top four measures which are design cost, design time, tendering requirements and relationship among stakeholders (average mean value = 6.85, 6.82, 6.78 and 6.62 respectively) there are no significant differences between the group of respondents: government officials, consultants and contractors. The next four measures were also rated as 'extremely important' are availability of pre-qualification contractors, alignment of stakeholder's requirements, availability of specifications and standards and planning, However, there is no consensus on the rank of importance among respondents in the three groups. Stakeholder involvement and Leadership are considered as very important measures and ranked in the ninth and tenth positions by mean 5.98 and 5.65. Regarding to Stakeholder involvement measure there is a significant difference (P value less than 0.05) between government officials, consultants and contractors.

6.2 Measures of Production Stage

Table 2 illustrates the participants' opinion in the production stage demonstrates the importance of certain measures for municipal construction projects. These measures represent seven performance measurement dimensions: time, cost, stakeholders' satisfaction, business, quality, management and project production. According to respondents' perceptions, the top eleven measures are extremely important which is high above the point score 6.14 and it has been observed through the result of ANOVA test that respondents do not have any significant difference with regards to their opinions and views on the ratings of measures. In the same context, time to rectify defects is an exception which has a difference between contractor and consultant where p value = 0.004, as well as for contractor satisfaction for payment there are significant differences between government officials and consultants and government officials and consultant where $P < 0.001$. The second level of significance is very important, where 12 measures were included by respondents. However, despite being deemed very important measures, there is no correspondence among participants on their significance. The remaining list of measures where 25 measures were considered to have less impact and are not key measures, as a consequence of this they were excluded from further analysis. From these results we can see that municipal construction projects in Saudi greatly emphasise on basic measures that listed the top ten measures as time, quality and cost along with specifications and standards, productivity and client satisfaction. However, some noteworthy differences are perceived statistically in rating participants' perception regarding the rest of the 38 measures for the second stage.

Table 1: Measures of Conceptual, Planning and Tendering Stage

Measures	Government	Contractor	Consultant	Average	Differences if Significant at the 5% level
Design Cost	6.89	6.77	6.89	6.85	No significant differences
Design Time	6.79	6.73	6.95	6.82	No significant differences
Tendering requirements	6.79	6.86	6.68	6.78	No significant differences
Relationship among stakeholders	6.53	6.59	6.74	6.62	No significant differences
Availability of pre-qualification contractors	6.74	5.82	6.58	6.35	GO v Contractor P < 0.001, Contractor v Consultant P = 0.003
Alignment of stakeholder's requirements	5.95	6.41	6.58	6.32	GO V Consultant P = 0.023
Availability of specifications and standards	6.00	6.05	6.84	6.28	GO v Consultant P = 0.001, Contractor v Consultant P = 0.001
Planning	5.89	5.95	6.74	6.18	GO v Consultant P = 0.05, Consultant v Contractor P = 0.007
Stakeholder involvement	4.84	6.41	6.63	5.98	GO v Contractor P< 0.001, GO V Consultant P<0.001
Leadership	5.11	6.00	5.79	5.65	GO V Contractor P = 0.014, GO v Consultant P= 0.092
Risk rate	4.11	6.14	4.79	5.07	Significant at P<0.001 GO v Contractor P <0.001, Contractor v Consultant P < 0.001, GO V Consultant P = 0.063
Project attribution	5.16	6.18	3.00	4.85	All comparisons significantly different
Safety requirements	3.00	5.36	4.58	4.37	All comparisons are significantly different
Environmental FAQ	3.95	3.14	4.68	3.88	All comparisons significantly different

Table 2: Measures of Production Stage

Measures	Government	Contractor	Consultant	Average	Differences if Significant at the 5% level
Construction cost	7	7	6.95	6.98	No significant differences
Availability of specifications and standards	6.95	6.91	7	6.95	No significant differences
Construction time	6.95	6.91	6.95	6.93	No significant differences
Productivity	6.89	6.95	6.89	6.92	No significant differences
Quality assurance systems	6.63	6.59	6.74	6.65	No significant differences
Project schedule and monitoring (procedure and process)	6.58	6.64	6.74	6.65	No significant differences
Time to Rectify Defects	6.42	6.95	6.26	6.57	Contractor v Consultant P = 0.004
Integration of design and construction	6.53	6.55	6.63	6.57	No significant differences
Client Satisfaction – Standard Criteria	6.47	6.5	6.63	6.53	No significant differences
Client Satisfaction – Specific Criteria	6.47	5.86	6.53	6.27	No significant differences
Contractor Satisfaction – Payment	4.74	7	6.68	6.18	GO v Contractor P < 0.001, GO v Consultant P < 0.001
Conflicts & claims	5.95	6.64	5.74	6.13	GO v Contractor P = 0.044, Contractor v Consultant P < 0.007
Profitability	5.16	6.68	6.21	6.05	GO v Contractor P < 0.001, GO v Consultant P = 0.001
Relationship among stakeholders	6	6.09	6	6.03	No significant differences
Team performance	4.95	6.68	5.68	5.82	GO v Contractor P < 0.001, Contractor v Consultant P < 0.001, GO v Consultant P = 0.014,

Cost to rectify defects in the maintenance period	5.79	6.32	5.16	5.78	Contractor v Consultant P < 0.001
Solving site problems	4.84	6.5	5.37	5.62	GO v Contractor P < 0.001, Contractor v Consultant P < 0.001
Planning	5.89	4.82	6.11	5.57	GO v Contractor P < 0.001, Consultant v Contractor P < 0.001
Waste of resources and materials	5.84	6	4.79	5.57	GO v Consultant P < 0.002, Contractor v Consultant P < 0.001
Profit predictability (project)	5.79	5.05	5.68	5.48	No significant differences
Risk rate	4.26	6.64	5.26	5.45	All comparisons are significantly different
Alignment of stakeholder's requirements	5.05	5.59	5.47	5.38	No significant differences
Leadership	4.05	5.91	6.05	5.37	GO v Contractor P < 0.001, GO v Consultant P < 0.001
Defects	5.37	5.18	4.95	5.17	No significant differences
Safety requirements	4.63	5.23	5.58	5.15	No significant differences
Reportable accidents	6.05	4.18	5.32	5.13	GO v Contractor P < 0.001, Contractor v Consultant P < 0.001, GO V Consultant P = 0.038
Number of Training	3.95	5.14	6.05	5.05	GO v Contractor P < 0.001, GO v Consultant P < 0.001, Contractor v Consultant P < 0.002
Change Orders	3.05	6.59	5.05	4.98	All comparisons are significantly different
Quality Issues at Available for Use	5.84	5	3.58	4.82	GO v Consultant P < 0.001, Contractor v Consultant P < 0.001, GO v Contractor P = 0.010
Stakeholder involvement	4.16	5.45	4.63	4.78	GO v Contractor P < 0.001, Consultant v Contractor P = 0.022
Environmental FAQ	4.53	4	5.42	4.62	GO v Consultant P = 0.012, Consultant v Contractor P < 0.001
Decision making procedures	4.05	4.77	4.53	4.47	GO v Contractor P = 0.003, GO v Consultant P = 0.085
Energy and water use	3.11	5.64	4.42	4.45	All comparisons are significantly different
Project organization structure	2.63	5.64	4.32	4.27	All comparisons are significantly different
Construction method and technology	3	4.23	4.95	4.07	GO v Contractor P < 0.001, GO v Consultant P < 0.001, Consultant v Contractor P = 0.022
Fatalities	4.16	4.73	3.05	4.02	GO v Consultant P = 0.005, Consultant v Contractor P < 0.001
Rework	2.95	5	3.95	4.02	All comparisons are significantly different
Communication and reports	3	4.32	4.42	3.93	GO v Contractor P < 0.001, GO v Consultant P < 0.001
Innovation	3.89	3	4.95	3.9	GO v Consultant P = 0.001, Contractor v Consultant P < 0.001, GO v Contractor P = 0.005
Rate of site meetings	2.16	4.45	4.74	3.82	GO v Contractor P < 0.001, GO v Consultant P < 0.001
Sustainability	4.42	1.55	5.79	3.8	All comparisons are significantly different
Project attribution	4	3.41	3.68	3.68	No significant differences
Waste -Percentage waste to landfill (m3)	4.21	1.68	5.05	3.55	GO v Contractor P < 0.001, Contractor v Consultant P < 0.001, GO V Consultant P = 0.011
Records of complaints regarding environmental issues	3.53	1.73	5.37	3.45	All comparisons are significantly different
Transfer of experience and best practice	2.74	2.73	4.63	3.33	GO v Consultant P < 0.001, Contractor v Consultant P < 0.001
Design Cost	1.89	4.73	1.79	2.9	GO v Contractor P < 0.001, Contractor v Consultant P < 0.001
Applying a new products and technology	1.95	2.77	4	2.9	GO v Consultant P < 0.001, Contractor v Consultant P < 0.001, GO v Contractor P = 0.016
Design Time	1.63	1.73	1.79	1.72	No significant differences

6.3 Measures of Operation Stage

In this stage, 15 performance measures were identified according to extensive reviewing with previous research in developed and developing countries. After conducting a mean value comparison approach based on organisation types which are government officials, consultants and contractors to identify the most important measures that are believed to be appropriate to judge construction project successfully, the 15 measures were ranked according to the mean score as seen in table 3. It appears from the results that satisfaction measures both for users and client were placed in the first and second ranking levels with average mean value 6.40 equally, while quality issues were place at the third rank level p value = 6.32. Despite these measures being considered as extremely important based on average mean for participants' perceptions, surprisingly there were significant differences between participants' views (government officials, consultants and contractors).

7. FINDING AND DISCUSSION

As stated previously, the purpose of this study is to determine the most significant measures to judge success of delivered construction projects in municipalities. According to this aim, a literature review of performance measurement systems was conducted that seeks to identify performance measures, whether for public or private construction projects. Consequently, it is found that the measures should be components of PMS (Neely, Marr, Roos, Pike, & Gupta, 2003) and measure all dimensions and goals that reflect stakeholder interests and are forward looking to be achieved by the end or even during all project phases (Takim & Akintoye, 2002) (Ugwu & Haupt, 2007). There is also a consensus in much research conducted on the inadequacy of the traditional measures of time, cost and quality to reflect the success of projects properly (Eriksson & Westerberg, 2011) (Yang, Yeung, Chan, Chiang, & Chan, 2010) (Takim, Akintoye, & Kelly, 2003). The current field work which collected data on practitioners' perspectives divided into three groups regarding the identified measures from the literature review are as shown in tables 1, 2 and 3. It is noted in analyses that government officials, consultants and contractors remain concerned with cost and time especially in the first and second.

Although the construction sector in Saudi Arabia is still emerging and suffering from many problems (Al-Otaibi & Price, 2009), the interests of key stakeholders who are in charge of delivery of municipal construction projects are looking forward to the farthest of the main measures that are currently applied. The new dimensions that need to be measured are time, cost, stakeholders' satisfaction, health & safety, environment, innovation and learning, business performance, quality, strategies and management and project production. The results indicate that there are three main stages in the construction projects; it is seen that there is no consensus on measures used among these stages to judge their success. Analysis illustrated and confirmed the practitioners' perspective that there are different measures for each of the three main stages. These findings are consistent with those previously reported in the literature reviews. Each stage is concerned with particular measures and this is based on the objectives that would be achieved at this stage as shown in Table 4. The first stage focuses on administrative and planning aspects; the second stage emphasises constructive aspects that include construction cost and time, specifications and standards, productivity, quality and satisfaction. The last stage deals with the level of satisfaction and achieving quality.

Table 3: Measures of Operation Stage

Measures	Government	Contractor	Consultant	Average	Differences if Significant at the 5% level
End-user satisfaction – product (Comfort to user expectations)	6.84	5.77	6.68	6.40	GO v Contractor $P < 0.001$, Contractor v Consultant $P < 0.001$
Client Satisfaction – Standard Criteria	6.74	5.82	6.74	6.40	GO v Contractor $P < 0.001$, Contractor v Consultant $P < 0.001$
Quality Issues at Available for Use	6.68	6.27	5.74	6.23	GO v Consultant $P = 0.002$
Integration of design and construction	6.63	5.36	6.58	6.15	GO v Contractor $P < 0.001$, Contractor v Consultant $P < 0.001$
Time to Rectify Defects	6.63	5.32	6.53	6.12	GO v Contractor $P < 0.001$, Contractor v Consultant $P < 0.001$
Defects	6.53	6.64	4.84	6.03	GO v Consultant $P < 0.001$, Contractor v Consultant $P < 0.001$
Cost to rectify defects in the maintenance period	6.47	4.82	6.68	5.93	GO v Contractor $P < 0.001$, Contractor v Consultant $P < 0.001$
Client Satisfaction – Specific Criteria	6.74	4.86	6.32	5.92	GO v Contractor $P < 0.001$, Contractor v Consultant $P < 0.001$
Safety requirements	6.00	5.50	5.63	5.70	No significant differences
Sustainability	6.00	1.86	6.26	4.57	GO v Contractor $P < 0.001$, Contractor v Consultant $P < 0.001$

Energy and water use	5.16	1.77	5.89	4.15	All comparisons are significantly different
Records of complaints regarding environmental issues	4.00	1.95	5.47	3.72	All comparisons are significantly different
Conflicts & claims	4.05	1.95	3.79	3.20	GO v Contractor $P < 0.001$, Contractor v Consultant $P < 0.001$
Environmental FAQ	3.05	1.91	4.74	3.17	All comparisons are significantly different
Fatalities	3.11	2.09	2.68	2.60	GO v Contractor $P = 0.004$

Table 4: Most Significances Measures for Three Stages

Measures of Conceptual, Planning and Tendering Stage Measures	Average	Measures of Production Stage Measures	Average	Operation stage measures	Average
Design Cost	6.85	Construction cost	6.98	End-user satisfaction – product (Comfort to user expectations)	6.40
Design Time	6.82	Availability of specifications and standards	6.95	Client Satisfaction Service – Standard Criteria	6.40
Tendering requirements	6.78	Construction time	6.93	Quality Issues at Available for Use	6.23
Relationship among stakeholders	6.62	Productivity	6.92	Integration of design and construction	6.15
Availability of pre-qualification contractors	6.35	Quality assurance systems	6.65	Time to Rectify Defects	6.12
Alignment of stakeholder's requirements	6.32	Project schedule and monitoring (procedure and process)	6.65	Defects	6.03
Availability of specifications and standards	6.28	Time to Rectify Defects	6.57	Cost to rectify defects in the maintenance period	5.93
Planning	6.18	Integration of design and construction	6.57	Client Satisfaction – Specific Criteria	5.92
Stakeholder involvement	5.98	Client Satisfaction Service – Standard Criteria	6.53	Safety requirements	5.70
Leadership	5.65	Client Satisfaction – Client-Specified Criteria	6.27	Sustainability	4.57

8. CONCLUSION

The extent to which a municipal construction project performance is measured successfully depends upon precision of an outstanding performance measurement system. To attain such a system, crucial dimensions should be included, for instance subjective or objective measures that take into consideration stakeholders' needs and expectations during the project lifecycle. When stakeholders requirements are collectively fulfilled, as well as individually, only then can it be stated that a successful construction performance is achieved.

The main aim of this current research it is to determine performance measures as part of the PhD research to create a performance measurement system for municipal construction projects in Saudi Arabia. In this research, a detailed examination of different performance measures to determine project success has been introduced.

From the statistical analysis, we can gain mean values of the responses and then rank them on the basis of these values. This may give an indication of their importance. After going over the detailed literature review, we were able to identify thirty important aspects divided into three stages. As noted to determine the finding's significance, ANOVA testing was conducted to discover if there were significant differences in the views of the three groups of respondents.

It is concluded that despite the weak performance of construction projects in Saudi Arabia, there is consensus among respondents in terms of the most important performance measurement metrics. These measures are not just basic measures that include time, cost and quality, but go beyond that to include other measures such as satisfaction, safety, environment, innovation and learning, financial measures, strategies and production measures. On this basis, it is suggested that it should be possible to design a comprehensive performance measurement framework using the identified measures in this study.

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