Journal of King Saud University – Engineering Sciences (2013) **25**, 125–134

King Saud University

Journal of King Saud University – Engineering Sciences

www.ksu.edu.sa
www.sciencedirect.com

ORIGINAL ARTICLE

Indicators for measuring performance of building construction companies in Kingdom of Saudi Arabia

Hany Abd Elshakour M. Ali, Ibrahim A. Al-Sulaihi *, Khalid S. Al-Gahtani

Civil Engineering Department, College of Engineering, King Saud University, Saudi Arabia

Received 28 October 2011; accepted 27 March 2012
Available online 12 April 2012

KEYWORDS

Benchmarking;
Performance measurement;
Key performance indicators (KPIs);
Construction industry;
Saudi Arabia

Abstract Slow economic growth, high competition, and construction industry restructuring have put a strong pressure on construction companies to continually improve their productivity and performance. Many studies on performance measurement have been carried out at the project level. However, recently, the demand for performance evaluation and management at the company level has increased. This paper aims to identify a set of KPIs that can be implemented by construction executives in measuring the performance at the company level in Saudi Arabia. List of 47 potential performance indicators have been identified through the literature review. A survey questionnaire was conducted on a randomly selected sample of large construction firms in Saudi Arabia. The statistical analysis of the collected responses was provided in 10 significant KPIs. Findings indicate that the traditional financial measures can no more be the sole determinant of firm success. Other performance indicators such as external customer satisfaction, safety, business efficiency, and effectiveness of planning are increasingly becoming important. The results of the study is a set of KPIs that are useful as a first step in developing a national benchmarking system for enhancing the performance of construction firms in the Kingdom of Saudi Arabia.

1. Introduction

Highly competitive and profound changes in the construction industry are forcing construction executives to continuously improve the performance of their firms. According to Luu et al. (2008), ''performance measurement is the heart of ceaseless improvement. As a general rule, benchmarking is the next step to improve contractors' efficiency and effectiveness of products and processes''. The main objective of performance evaluation is to assist managers and members of the organization in developing the direction, traction and speed of their organization (Cokins, 2006). Benchmarking can be applied by an organization to measure and compare its performance against results from recognized leaders for the purpose of identifying the strengths and weaknesses in performance, then using lessons learned from the best ones to determine the best practices that can lead to superior performance when adapted and implemented (El-Mashaleh et al., 2007; Stapenhurst, 2009).

* Corresponding author. Tel.: +966 548010390.
E-mail addresses: halii@ksu.edu.sa (Hany Abd Elshakour M. Ali), ialsulaihu@ksu.edu.sa (I.A. Al-Sulaihi), kgahtani@ksu.edu.sa (K.S. Al-Gahtani).

Peer review under responsibility of King Saud University.

ELSEVIER Production and hosting by Elsevier

1018-3639
http://dx.doi.org/10.1016/j.jksues.2012.03.002

For measuring the performance of companies and for applying benchmarking approach, one must first establish suitable key performance indicators (KPIs) that are most critical in determining the overall success of the company. KPIs are compilations of data measures used to assess the performance of a construction operation (Cox et al., 2003). KPIs play a key role in providing information on the performance of construction tasks, projects, and companies.

Many researches and studies are conducted to determine KPIs. Most of them are project specific. They concentrate on the performance measurement at the project level. Existing research, which has been conducted for performance evaluation and comparison at the company level, is limited in the literature. Moreover, most of the conducted researches have developed KPIs that are suitable for specific national features.

In Saudi Arabia, a few previous efforts have been done to identify indicators that can be used to measure the performance of construction projects. No insight is provided into the overall performance of the firms. Therefore, a set of KPIs that can be used to measure and compare the performance of an organization or be considered as a basis for benchmarking is lacking. To bridge this gap, this research aims to identify a set of KPIs that can be implemented by construction executives in measuring the construction performance at the company level in Saudi Arabia. More specifically, our research objectives are: (1) to highlight the national and international efforts and progress in identifying and implementing KPIs; (2) to determine the extent of implementing benchmarking approach in construction firms in Saudi Arabia; and (3) to identify the most important KPIs that can be used to evaluate the performance of construction companies in Saudi Arabia.

It is important to note that the study focuses on identifying KPIs for the purpose of performance measurement and benchmarking performance of construction firms and not for evaluation by clients or shareholders. Additionally, building construction firms are considered firms that undertake construction of building facilities and can include a design function.

2. Background

The following subsections provide background information on benchmarking, benchmarking in the construction industry, and different performance perspectives (classifications of performance indicators) as they pertain to this research.

2.1. Background on benchmarking

Camp (1989) wrote the first definitive book on benchmarking and defined benchmarking as "the continuous process of measuring products, services, and practices against the toughest competitors or those companies recognized as industry leaders". The Construction Industry Institute (CII) has adopted the following definition of benchmarking: "A systematic process of measuring one's performance against results from recognized leaders for the purpose of determining best practices that lead to superior performance when adapted and implemented" (Hudson, 1997 cited in El-Mashaleh et al., 2007).

There are several ways to classify types of benchmarking. Based on the environment against benchmarking, the classifications of benchmarking are: internal, competitive, and functional. Internal benchmarking is carried out with similar business units within the same organization, for example, between different branches, geographically scattered subsidiaries, and divisions. Competitive benchmarking involves comparing the products, services, and performance of an organization with those of its direct competitors in the same industry. Functional benchmarking identifies best practices in any type of organization, and then compares the performance of the company with the best practices applied in other companies operating in other fields (Camp, 1989; Watson, 2007; CCIC, 2006; Swan and Kyng, 2004).

Based on the application level of benchmarking, benchmarking was broken down into the following levels: (1) task (e.g. project specific activities such as placement of steel or concrete); (2) project (e.g. cost of the project or phases in the project life cycle, times for design or construction, cost and time predictability, health and safety issues, and client satisfaction); (3) organization (e.g. profitability of the company, productivity, training, human resources, ability to innovate); (4) industry (e.g. industry productivity, ability to innovate, image, human resources); and (5) economy (e.g. international competitiveness, financial capacity, and productivity) (Rankin et al., 2008).

2.2. Benchmarking in the construction industry

In construction industry, the application of benchmarking including the identification of KPIs has emerged in many academic journals and technical reports. Most studies and researches in the construction industry have concentrated on the performance measurement and evaluation at the project level. The significant performance indicators resulted from such available researches are summarized in Table 1.

Existing research, which has been conducted as a performance evaluation and comparison at the company level, is limited in the literature. Some institutes, such as the Construction Industry Institute (CII) in the USA, the Department of Environment, Transport, and the Regions (DETR) and the Department of Trade and Industry (DTI) in the UK, and the Corporation for Technical Development in Chile, have developed KPIs that are, to some degree, suitable for their own national features. Table 2 summarizes the significant performance indicators resulting from available studies that are used for performance evaluation at the company level.

On the other hand and due to the solid foundation for metrics in the basic areas at the project level; i.e. cost, time, scope, quality, and safety, project level data have been aggregated to evaluate organization performance (DETR, 2000). However, the methods to aggregate data from the project level to the organization level are not yet clear (Rankin et al., 2008).

Tables 1 and 2 showed that KPIs differ from one country to another. Different market situations, policies and strategies, cultures, and competitive environments require different measures (Kaplan and Norton, 1993). Therefore, a need exists to develop a set of KPIs that suits the environment in Saudi Arabia.

2.3. Classification of performance indicators in construction industry

Formerly, construction companies used financial measures to measure and evaluate their performance. "The dissatisfaction with financially based performance measurement started in

Table 1 Summary of available previous studies on performance indicators at project level.

No.	Author and year	Country	Performance indicators	
1	Jastaniah (1997)	Saudi Arabia	1. Client satisfaction 2. Planning period 3. Staff experience 4. Communication 5. Safety	6. Closeness to budget 7. Profitability 8. Payment 9. Claims
2	Egan (1998)	UK	1. Predictability – time, cost 2. Construction cost 3. Construction time 4. Productivity	5. Profitability 6. Safety 7. Defects 8. Client satisfaction
3	Department of the Environment, Transport, and the Regions (DETR), 2000 Department of the Environment, Transport, and the Regions (DETR) (2000)	UK	1. Time 2. Cost 3. Quality 4. Client satisfaction	5. Client changes 6. Business performance 7. Health and safety
4	Pillai et al. (2002)	India	1. Benefit 2. Risk 3. Project status 4. Decision effectiveness 5. Production	6. Cost effectiveness 7. Customer commitment 8. Stakeholders 9. Project management
5	Cheung et al. (2004)	China	1. People 2. Cost 3. Time 4. Quality	5. Safety 6. Client satisfaction 7. Communication 8. Environment
6	Wong (2004)	UK	1. Staff experience 2. Resources 3. Site management 4. Safety	5. Contractor experience 6. Time 7. Cost 8. Quality
7	Constructing Excellence (2005, 2006, 2009) and Roberts and Latorre (2009)	UK	1. Client Satisfaction 2. Defects 3. Predictability cost, time 4. Construction cost, time 5. Variance cost, time 6. Contractor satisfaction	7. Profitability 8. Productivity 9. Safety 10. Social indicators 11. Environment
8	Rankin et al. (2008) and Canadian Construction Innovation Council (CCIC) (2007	Canada	1. Cost 2. Time 3. Quality 4. Safety	5. Scope 6. Innovation 7. Sustainability 8. Client Satisfaction
9	Luu et al. (2008)	Vietnam	1. Construction cost 2. Construction time 3. Customer satisfaction 4. Quality management	5. Team performance 6. Change management 7. Material management 8. Safety
10	Skibniewski and Ghosh (2009)	USA	1. Construction cost 2. Construction time 3. Predictability cost and time	4. Defects 5. Client satisfaction product
11	Toor and Ogunlana (2010)	Thailand	1. On time 2. Under budget 3. Specifications 4. Efficiently 5. Effectiveness	6. Safety 7. Defects 8. Stakeholders 9. Disputes
12	Construction Industry Institute (CII) (2011)	USA	1. Cost 2. Schedule 3. Changes	4. Accident 5. Rework 6. Productivity

the 1950s and has built momentum since the late 1970s'' (Bassioni et al., 2004). The main problem lies in the fact that financial indicators are lagging indicators, in the sense that they tell the results of managerial actions already taken. However, managers need current, up-to-date, and mostly nonfinancial information to be able to take better decisions (Bassioni et al., 2004). After a long dependence on financial measures, many studies and researches have been conducted to develop performance measurement frameworks that included financial and nonfinancial indicators. The balanced scorecard (BSC), first proposed in 1992 issue of Harvard Business Review (HBR) by Kaplan and Norton, presents four different perfor-

Table 2 Summary of available previous studies on performance indicators at company level.

No.	Author and years	Country	Performance indicators	
1	DETR (2000)	UK	1. Profitability 2. Productivity 3. Return on capital employed	4. Return on value added 5. Interest cover 6. Ratio of value added 7. Repeat business
2	DTI (2002)	UK	1. Customer satisfaction 2. People 3. Environment	
3	El-Mashaleh (2003) and El-Mashaleh et al. (2007)	USA	1. Schedule performance 2. Cost performance 3. Client satisfaction	4. Safety 5. Profitability
4	Ramirez et al. (2004) , Alarcon et al. (2001)	Chile	1. Safety 2. Productivity 3. Quality 4. Efficiency of labor 5. Rework	6. Training 7. Planning effectiveness 8. Cost variation 9. Schedule variation
5	Yu et al. (2007)	Korea	1. Profitability 2. Growth 3. Stability 4. Customer satisfaction 5. Market share	6. Development 7. Technological capability 8. Business efficiency 9. Informatization 10. Organization competency
6	Nudurupati et al. (2007)	UK	1. Quality 2. Clients satisfaction 3. Employee satisfaction 4. Environment impact	5. Safety 6. Time 7. Cost
7	Wang et al. (2010)	USA	1. profitability 2. Return on capital 3. Cash flow 4. Reliability 5. Customer focus	6. Market shear 7. Quality 8. Internal business 9. Innovation and learning 10. Environment
8	Horta et al. (2010)	Portugal	1. Productivity 2. Profitability 3. Growth	4. Safety 5. Customer satisfaction 6. Predictability

mance perspectives from which executives can choose measures. The BSC complements financial indicators with operational measures on customer satisfaction, internal processes, and the organization innovation and improvement activities – operational measures that are the drivers of future financial performance. Additional general perspectives have been identified, such as competition (Neely et al., 1995) and employee (Neely et al., 2000), as well as application-specific perspectives, such as project and supplier for construction (Kagioglou et al., 2001; Wang et al., 2010). Constructing Excellence Organization in UK which aims to improve construction performance in order to produce a better built environment, developed a set of performance indicators and classified them into three main groups, namely; economic, social and environmental perspectives (Constructing Excellence, 2009). Syuhaida and Aminah (2009) classified performance indicators into functional, operational, and professional perspectives.

Over the last few decades many quality management models have been adopted for the purpose of enhancing performance. The most-utilized models are the Malcolm Baldrige National Quality Award in the United States, the European Foundation for Quality Management (EFQM) Excellence Model in Europe, and the Deming Prize in Japan. Through usage and research, the Baldrige and EFQM Excellence Models continued to grow in stature throughout the 1990s. They were recognized as descriptive holistic business models, rather than just quality models and mutated into frameworks for Business Excellence (Oakland and Marosszeky, 2006).

The USA Baldrige Model aims to promote performance excellence and improvement in competitiveness through a framework of seven categories which are used to assess the organization leadership, strategic planning, customer focus, measurement, analysis and knowledge management, workforce focus, operations focus, and results (National Institute of Standards and Technology (NIST), 2011)).

The EFQM Excellence Model operates through a simple framework of performance improvement through involvement of people in improving processes. The full Excellence Model is a framework for achieving good results (people results, customer results, society results, and key results) through the enablers (leadership, people, strategy, partnerships and resources, processes, products and services) (EFQM, 2011). The framework includes proposed weightings for performance assessment.

Based on the above mentioned models and studies, the potential performance indicators in this study were classified into five perspectives: financial, customer, internal business process, learning and growth, and environment.

3. Research methodology

The determination of KPIs is an initially important step in establishing a performance measurement system. These KPIs, when identified and implemented properly, can play a key role in providing information on the performance of construction companies. To determine and analyze the set of perceived KPIs utilized by construction executives in the construction industry in Saudi Arabia, the large construction companies specialized in building works in Saudi Arabia were targeted and a representative sample of this population was determined.

The potential key performance indicators that can be used to evaluate and compare the performance of construction companies were identified from literature review. These KPIs formed the basis of a questionnaire, which was used to sample the opinions of construction executives on the degree of importance of the key performance indicators. Through data collection and analysis, the relative importance of the key performance indicators was identified using the relative importance index. The detailed research approach is thoroughly introduced in the following sections.

3.1. Performance indicators and questionnaire design

A set of 47 raw KPIs were initially obtained from rigorous literature review of previous studies on KPIs/success criteria. These indicators were classified under five performance perspectives. The classified 47 KPIs formed the basis of a questionnaire survey. The questionnaire is divided into four major parts. The first part contained questions about the construction firm; for example the number of employees, annual work volume and how long the firm has been in building construction industry. It also provided general information about the individual completing the questionnaire such as their positions and the number of years of experience in current position. The second part included questions about the extent, importance, and mechanism of applying KPIs in construction firms. The third part contained question about the degree of utilization of benchmarking approach in construction organizations in Saudi Arabia, and which benchmarking type is the most dominant. In the fourth part, the construction executives were asked to rate each KPI based on their professional judgment on a given five-points Likert-type scale (where 1 = very low importance, 2 = low importance, 3 = medium importance, 4 = high importance, and 5 = very high importance). At the end of each group of indicators in this part, the chance was given to respondents to add and rate any additional indicator.

3.2. Sample size

The target population of the study is the large building construction firms working in Saudi Arabia. A representative sample was selected from the 2010 classified contractors list which is published by Contractors' Classification Agency, Ministry of Municipal and Rural Affairs in Saudi Arabia. The sample was selected from contractors classified and registered as "Grade 1" companies working in Saudi Arabia. The list of "Grade 1" companies includes 67 building contractors. The sample size that would represent this population was calculated based on the following formula (Kish, 1995):

$$n = \frac{n'}{[1 + (n'/N)]} \tag{1}$$

where

$$n' = \frac{(p \times q)}{V^2} \tag{2}$$

where n = the required sample size, n' = the first estimate of sample size, N = the population size, P = the proportion of the characteristic being measured in the target population, $q = 1 - p$, and V = standard error of sampling population. For the purpose of getting the maximum sample size, the values of p and q were taken as 0.5. The standard error used in determining the sample size was set equal to 10%, which represents the maximum standard error allowed (AlSalman, 2004). Substituting the pre-defined variables, a sample size of $n = 18.2$ is obtained. In other words, the minimum required response rate is 27.2%. A total of 67 questionnaires were delivered to the respondents, together with a covering letter explaining the purpose of the study and assuring them of anonymity.

3.3. Data analysis

The participating respondents have provided numerical scoring expressing their opinions on the degree of importance of each KPI. The data collected were analyzed using various statistical methods. The relative importance of the KPIs was identified using the relative importance index (Eq. (3)) (Aibinu and Odeyinka, 2006)

$$\mathrm{RII} = \frac{\sum_{i=1}^{5} W_i X_i}{A \times n} \tag{3}$$

where W_i = the weight given to the ith response: $i = 1, 2, 3, 4, 5$, X_i = frequency of the ith response, A = the highest weight (5 in this study), and n = the number of respondents.

4. Characteristics of respondents and firms

A total of 24 surveys were completed and returned, resulting in a 35.8% response rate, which is greater than the minimum required response rate of 27.2%. About 87.5% of the construction firms that participated in this study had more than 150 employees, and only 12.5% had less than 150 employees. With respect to the annual volume, 21% of the firms had annual volume less than Saudi Ryial (SR) 250 million. This was followed closely by the range SR 250–500 million, with 13%. Eight percent of the firms were in the range SR 500–750 million. Of the remaining firms, 4% were in the range SR 750–1000 million, 21% were more than SR 1000 million, and 33% of the respondents did not answer this question. The respondents were asked to provide the number of years that their firms worked in the building construction industry. Eight percent of the firms have been in building construction industry for less than 5 years, 4% for 6–10 years, and 88% for over 10 years. The result shows that the majority of firms (88%) worked more than 10 years in the building construction industry and this means

that most of the firms which participated in this study have long experience in this field. This elongated experience in construction industry should give high reliability for the results of the study.

5. Extent of application of KPIs and benchmarking

Many construction companies in Saudi Arabia identify KPIs to evaluate their performance. Fifty-eight percent of the construction firms (14 companies) that participated in this study used KPIs in evaluating company performance. Fifty-seven percent of them (eight companies) believed that identifying and using KPIs is very important to improve their performance. Most of them used five to ten indicators to measure the performance each six months. Benchmarking is not commonly used in the construction industry in Saudi Arabia. Only 25% of the construction firms that participated in the study (six firms) apply benchmarking approach. Thirty-three percent of respondents (eight firms) believed that benchmarking is very important as a means for improving performance and the rest (67% = 16 firms) considered that benchmarking has a moderate importance in improving performance. Although all the respondents (24 companies) realized the importance of benchmarking as a methodology for improving performance at the company level, the benchmarking application in Kingdom of Saudi Arabia is still limited due to the lack of national based benchmarking system, which can be used to assess and compare organizations' performance in Saudi Arabia. The internal benchmarking is the only type that is applied by the construction firms in Saudi Arabia. Internal benchmarking requires less time and resources, provides accurate information, and is usually the first step in any benchmarking application. Also internal benchmarking can reveal many opportunities for performance improvement, and aims to narrow the performance gap between different divisions of the same organization.

6. Ranking of performance indicators

The main purpose of this step is to identify the appropriate KPIs that can be used to measure the performance of the construction companies. Table 3 shows the mean value, standard deviation, and relative importance index (RII) of 47 indicators. Standard deviation of each indicator was relatively small enough to conclude and the respondents agreed on its importance.

Normally, the organizational performance is measured in terms of KPIs. Since too many KPIs can be unmanageable, management must select appropriate KPIs. According to Swan and Kyng (2004), the suitable number of KPIs should be 8–12. Table 4 shows the most important 10 indicators based on the values of RII, along with proposed measurement methods collected from the literature.

7. Discussion of study results

The complexity of managing an organization today requires that managers be able to view performance in several areas simultaneously. No single measure can provide a clear performance target or focus attention on the critical areas of business. Many have criticized financial measures because of their well-documented inadequacies, their backward-looking focus, and their inability to reflect current value-creating actions. A set of measures that balances financial and operational measures should be the basis of any performance measurement system.

The study revealed that the top ranked KPIs were distributed among three perspectives namely, financial, customer, and internal business. These results indicated that the construction organizations realized that the traditional financial measures are not an inclusive measure of organization performance anymore. Insufficiency of traditional financial measures led to increased interest of non financial measures, such as external customer satisfaction, safety, business efficiency, and effectiveness of planning.

The study revealed that the financial perspective included four measures that received high ranking by respondents, namely profitability, growth, financial stability, and cash flow. Profitability is found to be the most important KPI for the construction company managers. Profitability is also considered as one of the most important indicators in many other studies, such as Wang et al. (2010) and Yu et al. (2007). Construction companies are business organizations that exist to accomplish tasks in the large environment. Two classes of objectives for business organization have been widely recognized: economic and non-economic. The most common corporate economic objectives concern profitability, return on investment (or equity or net assets), and growth. Therefore construction executives ranked profitability as the first indicator to measure (financial) performance of the company. Growth is ranked third among the 47 performance indicators by construction executives. Growth can be seen as a measure of success for the company. Financial stability and cash flow are ranked fourth and fifth among the 47 indicators, respectively. Survival can be measured by cash flow and financial stability. Financial performance indicators help construction executives to specify the particular actions they want employees to take and then measure to see whether the employees have in fact taken those actions (Kaplan and Norton, 1992). Increased profitability, high cash flow, and high growth should be the logical consequence of improvements in the fundamentals, i.e. quality, productivity, safety, time, cost, etc.

Many construction companies today have a corporate mission that focuses on the customer. How a company is performing from its customers' perspective has become, therefore, a priority for top management. The results indicated that the customer perspective encompassed three indicators, namely, quality of service and work, external customer satisfaction, and market share. Quality of service and work comes second in importance after profitability. Quality measures the defect level of deliverables as perceived and measured by the customer. This indicator affects many other indicators such as profitability, external customer satisfaction, market share, growth and financial stability. Quality should be managed – it does not just happen. Effective leadership, involvement of people, good process management, customer focus, and good supplier relationships are fundamental parts of the recipe of success. The results revealed that external customer satisfaction is considered heavily in measuring performance of the construction companies. This indicator is ranked sixth among the 47 indicators by construction executives. There is no doubt that construction organizations depend on their customers, therefore they should understand and meet their needs and expectations. Satisfaction of customers and other interested parties is necessary for the success of the project and organiza-

Table 3 Ranking of performance indicators.

No.	Perspective	Performance idicators	Mean	Standard deviation	RII %
1	Financial	Profitability	4.58	0.72	91.7
2	Customer	Quality of service and work	4.29	0.62	85.8
3	Financial	Growth	4.25	0.79	85.0
4	Financial	Financial stability	4.08	0.72	81.7
5	Financial	Cash flow	4.00	0.88	80.0
6	Customer	External customer satisfaction	4.00	0.98	80.0
7	Internal business	Safety	3.92	0.78	78.3
8	Internal business	Business efficiency	3.83	0.64	76.7
9	Customer	Market share	3.79	0.83	75.8
10	Internal business	Effectiveness of planning	3.75	0.74	75.0
11	Internal business	Labor efficiency	3.71	0.86	74.2
12	Internal business	Successful tenders rate	3.67	0.70	73.3
13	Learning and growth	Organization competency in management human resources	3.63	0.71	72.5
14	Environment	Risk control	3.63	0.92	72.5
15	Internal business	Managers competency	3.58	0.83	71.7
16	Environment	Partnership and suppliers	3.58	0.50	71.7
17	Financial	Reliability of financial performance	3.42	0.58	68.3
18	Internal business	Innovation	3.42	0.65	68.3
19	Learning and growth	Continuous improvement	3.42	0.72	68.3
20	Internal business	Productivity	3.38	1.01	67.5
21	Environment	Policy or law of government	3.38	1.01	67.5
22	Internal business	Resource management	3.33	0.96	66.7
23	Customer	Internal customer satisfaction	3.29	0.91	65.8
24	Customer	Number of new customers	3.29	0.75	65.8
25	Learning and growth	Investors in people	3.25	0.99	65.0
26	Financial	Capital	3.21	0.93	64.2
27	Internal business	Technological capability	3.21	0.83	64.2
28	Internal business	Number of high-performance professionals	3.13	0.85	62.5
29	Learning and growth	Motivation	3.13	1.03	62.5
30	Financial	Investment in development of new markets	3.08	1.06	61.7
31	Learning and growth	Human resource training and development	3.08	0.83	61.7
32	Customer	Value of money	3.04	1.04	60.8
33	Environment	Competitors	3.04	0.75	60.8
34	Customer	Competitive price	2.96	0.95	59.2
35	Internal business	Quality control and rework	2.92	0.58	58.3
36	Learning and growth	Informatization	2.92	1.06	58.3
37	Internal business	Defects	2.88	1.30	57.5
38	Learning and growth	Empowered work force	2.79	1.06	55.8
39	Internal business	Research and development	2.75	0.79	55.0
40	Customer	Hassle-free relationship	2.58	1.38	51.7
41	Financial	Interest cover	2.54	1.06	50.8
42	Internal business	Staff turnover	2.42	1.25	48.3
43	Environment	Impact on society	2.25	1.03	45.0
44	Environment	Waste	2.21	1.22	44.2
45	Environment	Energy use	2.08	0.97	41.7
46	Environment	Main water use	2.08	1.14	41.7
47	Environment	Impact on biodiversity	1.92	0.93	38.3

tion. In other words, increasing the satisfaction of customers and stakeholders through effective goal deployment, cost reduction, productivity and process improvement has proved to be essential for organizations to stay in operation (Oakland and Marosszeky, 2006). Finally, market share (the ninth ranked indicator) provided objective evidence that improves in customer satisfaction was being translated into tangible benefits.

Excellence in company performance derives from enablers that include leadership, people, resources, processes, and actions. Managers need to focus on such critical internal operations that enable them to satisfy customer needs. Formerly, the companies stressed high performance for each functional department. The new focus emphasized measures that integrated key business processes. The internal measures can include productivity, safety, quality, and business efficiency and effectiveness. The results indicated that the internal business perspective included three high ranked indicators, namely safety, business efficiency, and effectiveness of planning. The respondents felt that safety was a major competitive factor. Safety is ranked seventh among the 47 performance indicators by executives. With the increasing complexity of construction projects and the rapid increase of construction activities, construction safety has become a big concern because workers' injuries cause tremendous losses (Fang et al., 2004). The business efficiency and effectiveness of planning were ranked

Table 4 Summary of available measurement methods of KPIs.

Perspective	No.	KPIs	Measurement methods
Financial	1	Profitability (Constructing Excellence, 2006; Yu et al., 2007; Bizwiz, 2011)	• Return on Equity(ROE) = $\frac{\text{Net income after tax}}{\text{Shareholder equity}}$ • Economic Value Added (EVA) = (Net operating profit after taxes − money cost of capital) • ReturnonCapital(ROC) = $\frac{\text{Net operating income afte rtax}}{\text{Book value of invested capital}}$ • Net Income (NI) = (Total revenue − all expenses) • Profitability = $\frac{\text{Profit before tax and interest}}{\text{Total revenues}}$
	2	Growth (Yu et al., 2007)	• Volume of works growth rate • Revenues growth
	3	Financial stability (Yu et al., 2007)	• $DebtRatio = \frac{\text{Total debt}}{\text{Total assets}}$
	4	Cash flow (Bizwiz, 2011)	• CashFlow = $\frac{\text{Cashflowgeneratedfromoperations}}{\text{Currentliabilities}}$ • Cash Flow = $\frac{\text{Cash flow from0perations}}{\text{Net income}}$ • Cash Flow = $\frac{\text{Net cash flow−Current portions of long term debt}}{\text{Net cash flow from operations}}$ • Cash Flow = $\frac{\text{Cash flow from operations+fixed cost}}{\text{Fixed cost}}$
Customer	5	Quality of service and work (El-Mashaleh et al., 2007)	• $ReworkFactor = \frac{\text{Total direct cost of field rework}}{\text{Actual construction phase cost}}$ • PAF model = Prevention cost + Appraisal cost + Failure cost
	6	External customer satisfaction (Excellence 2006; El-Mashaleh et al., 2007; Rankin et al., 2008)	• Percentage of Repeat Customers = $\frac{\text{Number of repeated customers}}{\text{Total number of customers}}$ • Customer Satisfaction Survey • Number of Complaints
	7	Market share (Yu et al., 2007)	• MS = $\frac{\text{Company's volume of works in a market(unit)}}{\text{Total volume of works in that market(unit)}}$ • MS = $\frac{\text{Company's revenue in a market}}{\text{Total revenue available in that market}}$
Internal business	8	Safety (Excellence 2006; El-Mashaleh et al., 2007; Rankin et al., 2008)	• Safety Performance = $\frac{\text{Number of reportable accidents in amount of time}}{\text{Average number employed in that time}}$ • Incidents Rate = $\frac{\text{Number of recordable incidents}\times 200{,}000}{\text{Total site work hours}}$ • Time Lost = $\frac{\text{Amount of lost time to incidents}\times 200{,}000}{\text{Total site work hours}}$ • Accident Cost = $\frac{\text{Direct and indirect costs to accidents}\times 200{,}000}{\text{Total site work hours}}$
	9	Business efficiency (Yu et al., 2007; Bizwiz, 2011)	• Efficiency Ratio = $\frac{\text{Expenses}}{\text{Revenue}}$ • Net Profit Margin = $\frac{\text{Net profit after taxes}}{\text{Total revenue}}$
	10	Effectiveness of planning (Excellence 2006; El-Mashaleh et al., 2007; Rankin et al., 2008)	• Predictability Cost = $\frac{\text{Actual cost−Anticipated cost}}{\text{Anticipated cost}}$ • Predictability Time = $\frac{\text{Actual time−Anticipated time}}{\text{Anticipated time}}$ • Change Cost Factor = $\frac{\text{Total cost of changes in works}}{\text{Actual total cost of works}}$

eighth and tenth among the 47 indicators, respectively. These indicators can be viewed as a key core competency for the companies.

Intense global competition requires that companies make continual improvements to their existing processes and have the ability to achieve deliverables in less time and cost, and low defect and accident rate. The results revealed that performance indicators that classified under both learning and growth perspective got less importance by respondents.

Moreover, energy use, main water use, and impact on biodiversity are the lowest ranked indicators for measuring performance of construction companies. These indicators belong to the environment perspective. Comparing with the results of other studies in different countries, learning and growth, and environment indicators are heavily considered when construction executives assess the performance of their companies.

The results of this study suggested that the most important ten performance indicators can be used to evaluate the performance of construction companies and also can be considered as the basis for benchmarking. The question that needs an answer is how to measure these indicators? As Table 4 shows there are many ways and formulas to measure each indicator a standardized method of measurement should be existed to simplify the application of these KPIs and any proposed benchmarking methodology. This is the target of the next step of this research.

8. Conclusion

Performance measurement is one of the important aspects of company management. The major objective of this study was to explore the most important indicators for measuring company performance as perceived by large building contractors working in Saudi Arabia. In this paper, relying on a review of the national and international literature, 47 performance indicators classified under five performance perspectives were identified to assess performance of construction organization. Questionnaire form was then designed to collect data from large building construction companies working in Saudi Arabia. A total of 24 surveys were completed and returned. The second and third parts of this questionnaire intended to explore the extent of application, and importance of KPIs and benchmarking in building construction industry in Saudi Arabia. Despite the agreement of respondents on the importance of benchmarking approach, the competitive benchmarking application in Kingdom of Saudi Arabia is still limited due to the lacking of standard benchmarking system. The only type of benchmarking that is applied by some organizations in Saudi Arabia is the internal benchmarking which requires less time and resources. The statistical analysis of the collected responses regarding the degree of importance of the 47 performance indicators is provided using 10 most significant KPIs which include profitability, quality of service and work,

growth, financial stability, cash flow, external customer satisfaction, safety, business efficiency, market share, and effectiveness of planning. Energy use, main water use, and impact on biodiversity are the lowest ranked indicators for measuring performance of construction companies. The 10 indicators consistently perceived as being highly important can be used as a basis to build a model for evaluating the performance of construction companies and also can be considered as the first step for developing a competitive benchmarking approach.

This study focused on building construction companies working in Saudi Arabia where engineering companies in other disciplines were not included. In conclusion, it is recommended that more in-depth studies should be performed to better understand KPIs. Further studies may be conducted to standardize the methods for measuring the KPIs, to determine the relative weightings of KPIs, and/or to develop benchmarking model based on the identified KPIs to compare the performance of construction companies in Saudi Arabia. The findings seem to be localized; however, the methodology in this research is general; thus it may be applied to other construction companies with minor modifications.

Acknowledgments

This project was supported by King Saud University, Deanship of Scientific Research, College of Engineering Research Center. The authors would like to thank King Saud University, Riyadh, Saudi Arabia, for providing various facilities for conducting this study.

References

Aibinu, A.A., Odeyinka, H.A., 2006. Construction delays and their causative factors in Nigeria. J. Constr. Eng. Manage. 132 (7), 667–677.

Alarcon, L.F., Grillo, A., Freire, J., Diethelm, S., 2001. Learning from collaborative benchmarking in the construction industry. In: Proc. 9th Conference of International Group for Lean Construction, Singapore.

AlSalman, A.A., 2004. Assessment of risk management perceptions and practices of construction contractors in Saudi Arabia. Master Thesis, King Fahd University of Petroleum and Minerals, Saudi Arabia.

Bassioni, H.A., Price, A.D.F., Hassan, T.M., 2004. Performance measurement in construction. J. Manage. Eng. 20 (2), 42–50.

BIZWIZ Consulting, 2011. Wizard of business analysis. Available at: <http://www.bizwiz.ca/> (accessed February 2011).

Camp, R., 1989. Benchmarking: The Search for Industry Best Practices that lead to Superior Performance. ASQC Quality Press, Milwaukee, WI.

CCIC, 2006. Measuring the performance of the Canadian construction industry: metrics. Canadian Construction Innovation Council, Toronto, Ont. Available at: <www.ccic-ccic.ca/reports.html> (accessed February 2011).

CCIC, 2007. Measuring the performance of the Canadian construction industry: pilot project final report. Canadian Construction Innovation Council, Toronto, Ont. Available at: <www.ccic-ccic.ca/reports.html> (accessed February 2011).

Cheung, S.O., Suen, H.C.H., Cheung, K.K.W., 2004. A Web-based construction project performance monitoring system. Automat. Constr. 13, 361–376.

Cokins, G., 2006. Performance management. In: Adkins, T. (Ed.), Case studies in Performance Management: A Guide from the Experts. John Wiley & Sons, New Jersey, p. 1.

Constructing Excellence, 2005. Environment KPIs methods of measurement. UK Construction Industry Key Performance Indicators, London, UK. Available at: <http://www.constructingexcellence.org.uk/resources/publications/default.jsp> (accessed December 2010).

Constructing Excellence, 2006. Economic KPIs methods of measurement. UK Construction Industry Key Performance Indicators, London, UK. Available at: <http://www.constructingexcellence. org.uk/resources/publications/default.jsp> (accessed December 2010).

Constructing Excellence in partnership with Department of Business Enterprise and Regulatory Reform, 2009. UK Industry Performance Report. London, UK. Available at: <http://www.constructingexcellence.org.uk/resources/publications/default.jsp> (accessed December 2010).

Construction Industry Institute (CII), 2011. Benchmarking and metrics. Available at: <file:///D:/computer%20data%2011-1-2011/master%20thesis/Paper1/draft/master%20 thesis/reference/USED/33/Construction%20Industry%20Institute.htm> (accessed January 2011).

Cox, R.F., Issa, R.R.A., Ahrens, D., 2003. Management's perception of key performance indicators for construction. J. Constr. Eng. Manage. 129 (2), 142–151.

Department of the Environment, Transport, and the Regions (DETR), 2000. KPI Rep. for the Minister for Construction, KPI Working Group, London.

Department of Trade and Industry (DTI), 2002. Construction Products Industry Key Performance Indicators Handbook. Construction Products Association, London.

Egan, J., 1998. Rethinking construction. The report of the construction task force. Department of Trade and Industry, UK.

El-Mashaleh, M., 2003. Firm performance and information technology utilization in the construction industry: an empirical study. Ph.D. Dissertation. Gainesville, Florida: University of Florida.

El-Mashaleh, M., Minchin, R., O'Brien, W., 2007. Management of construction firm performance using benchmarking. J. Manage. Eng. 23 (1), 10–17.

European Foundation for Quality Management (EFQM), Shares what works, 2011. The EFQM excellence model. Available at: <http://www.efqm.org/en/> (accessed June 2011).

Fang, D.P., Huang, X.Y., Hinze, J., 2004. Benchmarking studies on construction safety management in China. J. Constr. Eng. Manage. 130 (3), 424–432.

Horta, I., Camanho, A.S., Costa, J.M., 2010. Performance assessment of construction companies integrating key performance indicators and data envelopment analysis. J. Constr. Eng. Manage. 136 (5), 581–594.

Hudson, D., 1997. Benchmarking Construction Project Execution. Ph.D. dissertation. University of Texas, Austin, Tex.

Jastaniah, Y., 1997. Performance evaluation and benchmarking of construction industry projects using data envelope analysis. Ph.D. Dissertation, Southern Methodist University.

Kagioglou, M., Cooper, R., Aouad, G., 2001. Performance management in construction: a conceptual framework. Constr. Manage. Economy 19, 85–95.

Kaplan, R.S., Norton, D.P., 1992. The balanced scorecard: measures that drive performance. Harv. Bus. Rev. 70 (1), 71–79.

Kaplan, R.S., Norton, D.P., 1993. Putting the balanced scorecard to work. Harv. Bus. Rev. 71 (5), 134–142.

Kish, L., 1995. Survey Sampling. John Wiley & Sons Inc., New York.

Luu, V.T., Kim, S., Huynh, T., 2008. Improving project management performance of large contractors using benchmarking approach. Int. J. Project Manage. 26, 758–769.

National Institute of Standards and Technology (NIST), 2011. Criteria for performance excellence. Baldrige Performance Excellence Program.

Neely, A., Gregory, M., Platts, K., 1995. Performance measurement system design: a literature review and research agenda. Int. J. Oper. Product. Manage. 15 (4), 80–116.

Neely, A., Mills, J., Platts, K., Richards, H., Gregory, M., Bourne, M., Kennerley, M., 2000. Performance measurement system design:

developing and testing a process-based approach. Int. J. Oper. Product Manage. 20 (10), 1119–1145.

Nudurupati, S., Arshad, T., Turner, T., 2007. Performance measurement in the construction industry: an action case investigating manufacturing methodologies. Comput. Ind. 58, 667–676.

Oakland, J., Marosszeky, M., 2006. Total Quality in the Construction Supply Chain, first ed. Elsevier Ltd, Great Britain.

Pillai, A.S., Joshi, A., Rao, K.S., 2002. Performance measurement of R&D projects in a multi-project, concurrent engineering environment. Int. J. Project Manage. 20, 165–177.

Ramirez, R.R., Alarcón, L.F.C., Knights, P., 2004. Benchmarking system for evaluating management practices in the construction industry. J. Manage. Eng. 20 (3), 110–117.

Rankin, J., Fayek, A.R., Meade, G., Haas, C., Manseau, A., 2008. Initial metrics and pilot program results for measuring the performance of the Canadian construction industry. Can. J. Civil Eng. 35, 894–907.

Roberts, M., Latorre, V., 2009. KPIs in the UK's construction industry: using system dynamics to understand. Rev. Constr. 8 (1), 69–82.

Skibniewski, M.J., Ghosh, S., 2009. Determination of key performance indicators with enterprise resource planning systems in engineering construction firms. J. Constr. Eng. Manage. 135 (10), 965–978.

Stapenhurst, T., 2009. The Benchmarking Book: A How-to-guide to Best Practice for Managers and Practitioners, first ed. Elsevier Ltd, United Kingdom.

Swan, W., Kyng, E., 2004. An introduction to key performance indicators. Centre for Construction Innovation.

Syuhaida, I., Aminah, M.Y., 2009. Benchmarking the performance of Malaysia's construction industry. Manage. Res. Pract. 1 (1), 1–13.

Toor, S.R., Ogunlana, S.O., 2010. Beyond the 'iron triangle': stakeholder perception of key performance indicators (KPIs) for large-scale public sector development projects. Int. J. Project Manage. 28, 228–236.

Wang, O., El_Gafy, M., Zha, J., 2010. Bi-level framework for measuring performance to improve productivity of construction enterprises. Constr. Res. Congr. 2, 970–979.

Watson, G.H., 2007. Strategic Benchmarking Reloaded with Six Sigma; Improve Your Company's Performance Using Global Best Practice. John Wiley & Sons, Inc., Hoboken, New Jersey.

Wong, C., 2004. Contractor performance prediction model for the United Kingdom construction contractor: study of logistic regression approach. J. Constr. Eng. Manage. 130 (5), 691–698.

Yu, I., Kim, K., Jung, Y., Chin, S., 2007. Comparable performance measurement system for construction companies. J. Manage. Eng. 23 (3), 131–139.