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## Original Article

# The performance measurement of construction projects managed by ISO-certified contractors in Malaysia

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**ABSTRACT** The construction industry often acts as a catalyst to stimulate the growth of a nation's economy. The industry is often referred to as an engine of growth. However, numerous government reports have criticized the industry's poor performance, especially in terms of productivity, quality and quality systems. In order to improve performance, many construction companies implement the ISO 9000 series, an integrated system to ensure consistency and better performance of construction projects. This is achieved by creating a framework for continuous improvement and by providing the necessary criteria to guide construction firms setting up and maintaining quality system in their organizations. This article examines the benefits of implementing ISO 9000 standard to construction companies and the criteria used for measuring project performance. The data were obtained from literature review and a postal questionnaire survey, which involves 30 managers employed in International Organization for Standardization-certified construction companies. This article concludes that functionality and clients' satisfaction are two of the most important criteria for measuring construction project performance, whereas time and cost were the least important.

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## INTRODUCTION

The construction industry has numerous problems to deliver quality construction projects because it comprises of a multitude of professions, occupations and organizations. The quality of service delivered by consultants has often been a subject of thorough investigations. Some clients have underestimated the impacts of substandard consultancy service to the success of a construction project (Barber *et al*, 2000). Many delays, cost overruns, reworks, variations, claims and disputes can be traced back to erroneous design, poor contract administration or lax supervision of the client's representative (Chini and Valdez, 2003). Furthermore, the production processes of construction projects are generally non-standardized; hence, it is difficult to ensure quality. Therefore, some local building authorities seek to alleviate the quality problem by making certification to ISO 9000 mandatory for all contractors who are tendering for public sector projects.

Errors induced by a system can be prevented or at least minimized through the implementation of a quality management system (QMS) (Latham, 1994). Among various QMSs, ISO 9000 certification has been widely adopted by the construction industry in many countries. For instance, in Hong Kong all consultants must have a certified ISO 9000-based QMS before they can bid for public construction projects (Works Bureau, 2001). With the release of ISO 9000:2000, an unprecedented emphasis is placed on customer satisfaction and continual improvement (Murphy, 2002). 'Satisfaction' can be measured by comparing the difference between what is expected and actually received (Hill *et al*, 2002), and clients would satisfy with the performance of a consultant when the quality of service provided exceeds or at least meets their expectations. Continual improvement can only be realized if consultants are aware of their weaknesses or deficiencies and make corresponding adjustments to satisfy the expectations of their clients (Love *et al*, 1998).

ISO 9000-based QMSs have been reported to be able to improve the service quality of the firm. This will subsequently increase the clients' satisfaction, market share, revenue as well as workers' morale. However, to what extent International Organization for Standardization (ISO)-certified contractors could satisfy clients' needs in construction projects are still inconclusive. There are still a lot of complaints reported relating to the quality of delivery. Therefore, this article will present the performance of construction projects carried out by ISO-certified contractors.

## DEFINITION OF QUALITY

BS 5750 (1987) defines quality as 'The totality of features and characteristics of a product or service that bear on its ability to satisfy stated or implied needs'.

Quality is understood differently by different people and different organizations. For instance, Lesley and Malcolm (1992) opined that quality is probably the best way of assuring customer loyalty, the best defence against foreign competition and the only way to secure continuous growth and profits in difficult market conditions. In order to manage quality, the starting point for the organization is to understand the meanings of the term 'quality'. In the views of Jabnoun (2000), quality is



defined as conformance to requirements. All of the definitions given above define quality from the perspective of the customers. In essence, quality can be understood as 'meeting the customer's expectation'. These definitions imply that the needs of the customer must be identified first because satisfaction of those needs is the 'bottom line' of achieving quality. For construction organizations, quality is defined as meeting the requirements of the owner need as to functional adequacy; completion construction project on time and within budget, life-cycle costs and operation and maintenance (Arditi and Gunaydin, 1997). Construction companies need to consider quality in the tendering process, contract review, project planning, financing control, sub-contractor and supplier selection, leadership and utilization, resource allocation and other management aspects (Abdul-Rahman, 1994).

### **QUALITY MANAGEMENT – ISO 9000**

As quality became a major focus of business throughout the world, various organizations started to practice standards and guidelines. This sees the introduction of the ISO 9000 series in 1987, which has since become a worldwide quality management norm for organizations, regardless of their sizes and products. The ISO 9000, originated from the military procurement standards in the Second World War, is a series of guidelines for companies that establish their quality systems by focusing on procedures, control and documentation. ISO 9000 standards are supposed to help companies identify mistakes, streamline their operations and be able to guarantee a consistent level of quality (Karth, 2002). The standard also drew the attention of quality professionals worldwide. Owing to its original intent to create a two-party, non-binding standard, it penetrated barriers of culture and language, which no other quality standard could achieve. Therefore, it became a non-political baseline for quality, accepted internationally as quality management framework and an excellent marketing tool for entering the global market. It gradually spread from Europe to North America, Japan and the rest of the world (Taormina, 2002).

Many studies reveal that effective implementation of ISO 9000 can benefit organizations through the improvement of management control (Lee, 1998), efficiency (Ebrahimpour *et al*, 1997), productivity (Terziovski *et al*, 2003; Terziovski and Power, 2007) and customer services (Yeung *et al*, 2003). With the revision of ISO 9000 by its publisher (the ISO) approximately every 7 years, the newest revision is called ISO 9000:2008 which was published on 14 November 2008. ISO 9001:2008 has been developed in order to introduce clarifications to the existing requirements of ISO 9001:2000 and to improve compatibility with ISO 14001:2004. Nevertheless, the research will focus on the ISO 9000 series of year 2000 since the latest 9000 series had just been published and most ISO-certified contractors have still yet to change their certification to the new ISO 9000:2008. The ISO 9000 series for the revision of year 2000 consist of the following:

- ISO 9000:2000 Quality Management Systems – Fundamentals and Vocabulary;

- ISO 9001:2000 Quality Management Systems – Requirements; and
- ISO 9004:2000 Quality Management Systems – Guidance for Performance Improvement.

The ISO 9000 series concentrate on the five key areas of quality-management systems, that is, management responsibility, resource management, product or service realization, measurement, analysis and improvement (Zuckerman, 2001; Cianfrani *et al* 2002).

Unlike the 1987 and 1994 versions, the 2000 version of ISO 9000 standards has incorporated many changes. Certified companies can have higher flexibility in integrating the environmental, health and safety standards with the new quality system (Coleman and Douglas, 2003). The combination of the former three elements (9001/2/3) into one (9001) has simplified the system, resulting in decreasing any artificial complexity in implementing ISO 9000 (Biazzo and Bernardi, 2003). Studies have also found an overall positive perception of the value of the ISO 9000–2000 quality system standard and a consistently higher appreciation of the 2000 version compared with the 1994 version. The results indicate that as far as this sample is concerned, the revision of ISO 9000 has proved that the 2000 version is an improvement from the 1994 version.

## **MEASURING PROJECT PERFORMANCE**

Performance measurement is defined as the process of evaluating performance relative to a defined goal. It provides a sense of where we are and, more importantly, where we are going (Rose, 1995). Rose further stated that measurement can guide steady advancement toward established goals and identify shortfalls or stagnation. Willis and Willis (1996) maintained the importance of measuring performance because it will indicate status and direction of a project.

It is widely accepted view that, at a minimum, performance measures of a project are based on time cost and quality (Barkley and Saylor, 1994). Atkinson (1999) noted that these three components of project performance as the 'iron triangle'. However, Kumaraswamy and Thorpe (1999) considered variety criteria in measuring a project. This includes meeting budget, schedule, the quality of workmanship, stakeholder's satisfaction, transfer of technology, and health and safety. Similarly, Chan and Tam (2000) noted that various other key components also used in measuring project performance such as health and safety, environmental performance, user expectation/satisfaction, actor's satisfaction and commercial value. Therefore, in this article, six variables have been identified for measuring project performance. They are cost, time, quality, clients' satisfaction, health and safety and functionality.

### **Cost performance**

Cost is defined as the degree to which the general conditions promote the completion of a project within the estimated budget (Bubshait and Almohawis, 1994). Salter and Torbett (2003) indicated that cost variance was the most common technique used to measure design performance. It is not only confined to the tender sum, but the overall cost that a project incurs from inception to completion, which includes any costs arise from



variations, modification during construction period and the cost arising from the legal claims, such as litigation and arbitration. It can be measured in terms of unit cost, percentage of net variation over final cost (Chan and Tam, 2000). Cost variance is a very important factor in measuring project performance because it indicates how much the project is over or under budget. Andi and Minato (2003) used cost variance to measure project performance caused by defective design in Japan's construction industry. Similarly, Georgy *et al* (2005) suggested the element of cost to measure the performance of engineering projects. Hence, in this article, cost variance is calculated by the variance between the actual cost and the budgeted cost of a project.

### **Time performance**

It is very important for construction projects to be completed on time, as the clients, users, stakeholders and the general public usually looks at project success from the macro view where their first criterion for project success appeared to be the completion time (Lim and Mohamed, 2000). Salter and Torbett (2003) and Odeh and Battaineh (2002) mentioned that time variance is one of the techniques for assessing project performance in construction projects. The element of time could indicate to project managers that the project was not running as smoothly as scheduled. Furthermore, Latham Report in 1994 suggested that ensuring timely delivery of projects is one of the important needs of clients of the construction industry. Construction time can be regarded as the elapsed period from the commencement of site works to the completion and handover of a building to the client. The construction time of a building is usually specified before the commencement of construction. Construction time can also be deduced from the client's brief or derived by the construction planner from available project information.

### **Quality performance**

In the construction industry, quality is defined as the totality of features required by a product or services to satisfy a given need, or fitness for purpose (Parfitt and Sanvido, 1993). In other words, the emphasis of quality in construction industry is on the ability to conform to established requirements. Requirements are the established characteristics of a product, process or service as specified in the contractual agreement and a characteristic is any specification or property that defines the nature of those products, processes or services, which are determined initially by the client. In order to achieve a completed project that meets the owner's quality expectations, all parties to a project must acquire an understanding of those expectations, incorporate them into the contract price and other contract documents to the extent possible, and commit in good faith to carry them out (Ganaway, 2006).

### **Clients' satisfaction**

Satisfaction is regarded as a function of comparison between an individual's perception of an outcome and its expectation for that outcome (Locke, 1970). In the construction industry, client's satisfaction has remained an elusive and challenging issue for some considerable



time. Dissatisfaction is widely experienced by clients of the construction sector and may be caused by many aspects but is largely attributable to overrunning project costs, delayed completion, inferior quality and incompetent service providers including contractors and consultants (*Contract Journal*, 2004). Research findings by BSRIA (2003) have suggested that it is five times more expensive to develop a new construction client than to maintain an existing one and companies could increase their profits by almost 100 per cent by retaining just 5 per cent more of their clients. Client's satisfaction is therefore a fundamental issue for construction participants who must constantly seek to improve their performance if they are to survive in the global marketplace. In the construction industry, the measurement of client's satisfaction is often associated with performance and quality assessment in the context of products or services received by the client (Parasuraman *et al*, 1988; Soetanto and Proverbs, 2004). Usually the client's requirements are to get construction needs translated into a design that specifies characteristics, performance criteria and conformance to specifications, besides to get the facilities built within cost and time (Ahmed and Kangari, 1995).

### **Health and safety**

Health and safety are defined as the degrees to which the general conditions promote the completion of a project without major accidents or injuries (Bubshait and Almohawis, 1994). The measurement of safety is mainly focused on the construction period as most accidents occur during this stage. Throughout the world, construction industry is known as one of the most hazardous activities. Thousands of people are killed and disabling injury annually in industrial accident. Construction workers worldwide have three times more chances of dying and two times of getting injured than any worker of other economic activity (Sousa and Teixeira, 2004). In Malaysia, Social Security Organization (SOCSO) reported out of the total of 73 858 industrial accidents recorded in 2003, 4654 were occurred in construction industries with 2 per cent or 95 cases resulting in deaths. There is no single reliable measure of health and safety performance. Traditionally, the safety performance is measured through injury statistic. The main purpose of measuring health and safety performance is to provide information on the progress and current status of the strategies, processes and activities employed to control health and safety risks. Effective measurement not only provides information on what the levels are but also why they are at this level, so that corrective action can be taken.

### **Functionality**

Chan (2001) considered 'functionality' as one success measure that is made in the post construction phase when the project is finished and delivered to service. Kometa *et al* (1995) opined that there would be no point in undertaking a project if it does not fulfil its intended function at the end. This indicator correlates with expectations of project participant and can best be measured by the degree of conformance to all technical performance specifications (Chan *et al*, 2002). Both financial and technical aspects implemented to technical specifications should be considered,



achieving the *fitness for purpose* objective. Songer and Molenaar (1996) defined specification as workmanship guidelines provided to contractors by clients or clients' representatives at the commencement of project execution. The measure of technical specification is to the extent that the technical requirements specified can be achieved. In addition to that, Songer and Molenaar (1997) consider *meeting specifications* as one success criterion for design-and-build projects that is consistent with the measurement of technical performance, which is to be measured in both the preconstruction and construction phases when the technical requirements are laid down.

## RESEARCH METHOD

Figure 1 sets out the flow of research method with the objective to measure the project performance in ISO-certified contractors, in terms of time and cost variances, level of complaints, clients' satisfaction, functionality, and health and safety. The variables for measuring project performance were identified through literature review.

The nature of this research project was quantitative rather than qualitative. Quantitative survey is often regarded as sterile and unimaginative but well suited to research projects that require factual and descriptive information (De Vaus, 1991). The collection of a large number of data was instrumental in order to achieve convincing results for this research. Hence, the first stage of the study started with the secondary data collection through extensive literature review from various sources comprising of reference books, journals, web sites, dissertations and conference papers. The literature review focuses on the areas of ISO 9000 standard and the project performance measurement.

The literature review was followed by a second stage of data collection, that is, questionnaire survey. A questionnaire that covered the respondent's profile, project characteristics and project performance variables was developed. The questions were structured mainly based on the two types of answering format, namely rating-based and selective-based. In the rating-based format, respondents were asked to rate the extent to which

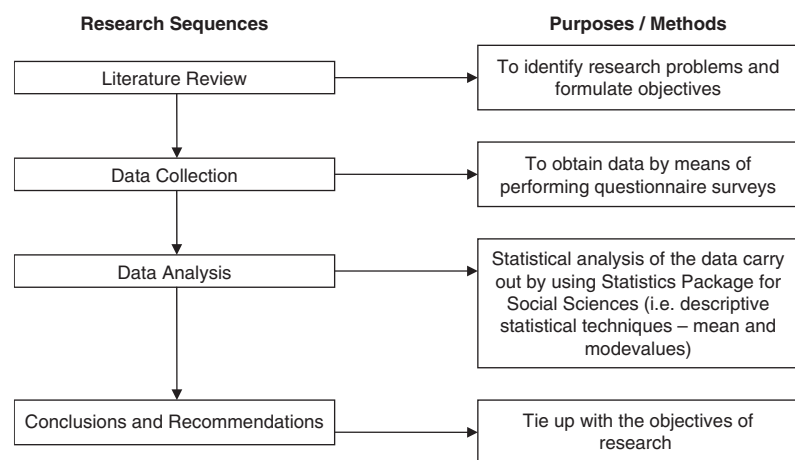


Figure 1: The flow of research method.



**Table 1:** Role of the respondents

<i>Role of respondents</i>	<i>Frequency (n=39)</i>	<i>Percentage</i>
Project Executive	4	10
Site Supervisor	5	13
Project Manager	13	34
Construction Manager	5	13
Others	12	30

**Table 2:** Response rate of the questionnaires

	<i>Questionnaire sent out</i>	<i>Questionnaire returned</i>	<i>Response rate</i>	<i>No. of valid return</i>
Questionnaires	112	39	34.80%	30

they agreed to a specific fact or opinion, using a 5-point Likert scale ranging from ‘very unsatisfied’ to ‘very satisfied’. The selective-based format requires the respondents to tick in the appropriate bracket. In addition to that, there is also an open-ended question. The questionnaire was designed to be simple and straightforward, enabling a wide range of views relating to the subjects of the research to be collected. This is then followed by the last stage where data analysis and transformation were carried out. Quantitative statistical analysis on the data was performed using the software Statistics Package for Social Sciences, version 16.0. Table 1 displays the role of the respondents participated in the questionnaire survey.

**RESEARCH FINDINGS AND DISCUSSION**

A total of 112 questionnaires were distributed to ISO-certified contractors registered with the Construction Industry Development Board Class G7 operating within Malaysia. Thirty-nine responses were received. However, nine questionnaires were found to be incomplete, invalid, and excluded from the survey. The summary of the responses is shown in Table 2.

The overall response rate was approximately 35 per cent out of the total distributed questionnaires. The data collection for this research project was considered successful because it met the 30 per cent response rate benchmark to produce reliable and convincing research results (Gillham, 2000).

The result in Table 3 indicates the degree of satisfaction of the respondents for measuring six project performance variables is generally good. The findings are arranged in rank order according to performance. The table shows that functionality scores the highest ranking, followed by clients’ satisfaction, health and safety, and level of complaints. Time and cost, with a mean score of 3.70 share the bottom ranking.

It is not surprising that functionality is considered as the most important criterion. Functionality means that the end products (buildings) should be fit for the purpose. The buildings are useless if it cannot be



**Table 3:** The degree of satisfaction for measuring project performance

Variables for measuring project performance	Mean (n=39)	Ranking
Functionality	4.57	1
Clients' satisfaction	4.17	2
Health and safety	3.90	3
Level of complaints	3.83	4
Time	3.70	5
Cost	3.70	5

used even though the projects satisfied all the other criteria shown in Table 3.

It is well recognized that functional design plays a central role in ensuring design quality and product innovation. Products with problems in their main functions do not sell well, no matter how sophisticated their details. This result supports Kometa *et al* (1995) observation that there would be no point in undertaking a project if it does not fulfil its intended function in the end.

Clients' satisfaction was ranked second as a measure of project performance. It is suggested that clients' satisfaction correlates with functionality. When the functionality of the product is good, the clients' satisfaction will definitely increase. In supporting the statement, Chan *et al* (2002) opined that it is important for project team members to accept clients' satisfaction as their goal, since without the client, there would be no reason for the project to be carried out.

Time and cost occupy the lowest ranking with mean value of 3.70. This is unexpected because they were identified as two of the most important variables for measuring project performance in many previous literatures. The contradiction between the present findings and the previous literature is probably because of the different priorities in different countries. Most of the contractors and clients in Malaysia are more concerned on the functionality of the products because of the defects in many high profile construction projects.

In addition, the time and cost performances were poor because of the complexity of construction projects, which results in excessive variations during construction. It is seldom for the contractors to complete a project without changes to the plans or the construction process. Literature survey reveals that most variations were induced by clients, architects, contractors and other stakeholders, including aspects of financial, design, aesthetic, changes in drawings, weather, geological and geotechnical reasons (Turner, 1984). An additional work normally has the effect of lengthening the contract, hence, affects the time performance. This, in turn, results in cost overruns.

## CONCLUSION

Literature review reveals that the effective implementation of ISO 9000 can benefit organizations through the improvement of management control efficiency, productivity and customer services. Functionality has been identified as the most important project performance criterion. On the other hand, time and cost performances were considered as the least



important, although they were identified as two of the most important criteria for measuring construction project performance in many literatures.

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