A QUALITATIVE SURVEY ON SUCCESS FOR MAINTENANCE PROJECTS

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Abstract

Key Performance Indicators (KPIs) are the criteria of measuring project performance in order to attain construction excellence. Previous researchers have examined the abstract concept of success for general new construction and identified its relationship with the factors of success. In fact, most buildings exist to satisfy the needs of people. With the passing of time and change in technology, buildings have to be maintained and renovated in order to continue functioning properly for the benefits of users. Therefore, criteria and factors of success have increasingly attracted the attention of both researchers and practitioners, especially in cities where buildings become ageing. However, the topic of project success for maintenance projects is less discussed in previous research, and project participants, including maintenance surveyors should be able to identify the success measurement and its associated factors for performance improvement. This study fills the research gap by investigating the criteria and factors of success for maintenance projects. It first provides a summary of the literature review on the criteria and factors of success for construction projects. An empirical study has also been carried out with ten practitioners in Hong Kong to further identify the criteria and factors critical for the success of maintenance projects in practice. While most criteria and factors of success for new construction projects are also applicable to maintenance projects, participants in maintenance projects believe that effective communication is in particular important to provide quality service to the end-users.

Keywords: Key performance indicators, success criteria, success factors, maintenance projects.

1. Introduction

Most buildings exist to satisfy the needs of people. As time passes by, maintenance of buildings becomes an invaluable process which plays an integral role in retaining the value and quality of a building. In a time of globalization and an increasingly competitive environment, measuring performance has become critical to business success (Bassioni et al., 2004). As a result, recent research efforts have been put on the study of performance management, which is actually a core element of maintenance management (Zhu et al., 2002). Performance measurement has long been considered as the evaluation of past

actions in order to take corrective action [1]. Study for maintenance projects using the performance approach can provide opportunities to improve cost, risk and quality management of the properties concerned in the long-term.

In most cases, the performance levels on the technical, aesthetic and environmental aspects of the building will be evaluated. Shohet and Lavy [2] investigated the performance management on maintaining healthcare facilities and found out that the procedure involved requires the identification, characterization, and definition of several key performance indicators (KPIs), which may also be used as benchmarks for the effectiveness of project performance. In fact, benchmarking is about comparison with a best practice with a view to increasing output performance and hence value to the organization [3]. Previous researchers have subsequently made use of the concept of benchmarking and develop a set of success criteria or KPIs to measure project performance (Lam et al., In press). Yu et al. [4] added that a conceptually coherent set of project success criteria can potentially help project participants to channel their efforts to achieving successful projects. However, it has been difficult to reach a consensus on the abstract concept of project success as well as project success factors which differ significantly between project participants. Moreover, most research has focused on managing new construction and Wood [5] claimed that building maintenance is even under-researched. This study sets out to evaluate success for maintenance projects in construction. It begins with outlining the methodology for the research. Findings from the literature survey and structured interviews will be presented, followed by conclusions for the research.

2. Methodology

The aim of this paper is to evaluate success for maintenance projects in construction. It has the objectives to develop success criteria, or key performance indicators (KPIs) and success factors for maintenance projects. The research disseminates the preliminary findings of establishing a benchmark model for maintenance projects. Similar research has been undertaken by the authors on the perceptions on the D&B procurement method from the viewpoints of the stakeholders [6]. The present research is conducted by means of literature survey and structured interviews. Relevant textbooks, high-ranked journal papers and conference proceedings were screened for the criteria and factors of success for construction projects reported by previous researchers and practitioners. Research efforts have also been put on organizing structured interviews with the participants of maintenance projects in the Hong Kong construction industry. The interviewees were selected from local client and contractor organizations, and they were contacted between May and June 2006. A list of questions was attached to the letter of invitation, and the interviews were recorded and transcribed for subsequent analysis. Findings of the structured interviews were analyzed and quantified to differentiate the responses of the project participants and to obtain the relative importance of the attributes.

3. Key Performance Indicators for Construction Projects

A key performance indicator (KPI) is the measure of the performance of the process that is critical to its success [7]. When it is not possible to obtain a precise measurement, it is usual to refer to performance indicators. Cox et al. [8] defined KPIs as compilations of data measures used to evaluate the performance of a construction operation. The information collected can then be used for benchmarking purposes, and will be a key component of any organisation's move towards achieving best practice. Although there are various methods

for implementing benchmarking, the ultimate goal revolves around the issue of performance [7].

Previous researchers have investigated the process of developing KPIs and their classifications in construction. Collin [9] developed KPIs by consideration of eight factors, and suggested that KPIs should be "accepted, understood and owned across the organization". Takim and Akintoye [7] considered KPIs from result-orientated to process-orientated thinking. The former involves measurement on results, such as the achievement of objectives, users' satisfaction and the use of the project; whereas the latter concerns measurement on process: getting the project out on time, on budget and meeting a quality threshold [10]. While Chan et al. [11] perceived criteria of success from subjective and objective measures, Shohet [12] described KPIs as a set of focused criteria that represent the organizational performance most critical to the success of the organization. He investigated the maintenance practice of hospital facilities and integrated four aspects of hospital facilities management: performance management, composition of labour, efficiency of maintenance operations and organizational effectiveness. The indicators indeed provide a wide perspective in the examination of the maintenance issue in hospital facilities.

4. Defining Success in the Construction Industry

The definition of success often changes from project to project but Parfitt and Sanvido [13] claimed that the criteria for success can commonly be developed to assess the performance of a project. Traditionally, success is defined as the degree to which project goals and expectations are met. Each project has a set of goals to accomplish, which serve as a standard to measure performance. Chan et al. [11] summarized the different views of previous researchers on project performance into focusing on meeting objectives, taking a global approach and considerations beyond the project. Later researchers, such as Dvir [14] described the three measures of project success as project efficiency, customer benefits and the overall success.

The common assessment of the success of construction projects is that they are delivered on time, to budget, to technical specification and meet client satisfaction. Takim and Akintoye [7] cited the research by the UK working group on the identification of seven project performance indicators (construction cost, construction time, cost predictability, time predictability, defects, client satisfaction with the product and client satisfaction with the service) and three company performance indicators (safety, profitability and productivity). Lam et al. [15] further conducted research in defining success for D&B projects and developed a Project Success Index (PSI) with the success criteria of time, cost, quality and functionality. Other previous researchers have seen the importance of maintaining construction projects and investigated the issue of project success in non-new construction. The CIRIA Report [16] believed that the basic objectives of cost, time and quality should be present on all projects and major refurbishment projects are often supplemented by other considerations such as minimal disruption to the operation of the building and safety of its occupants and users. This view was echoed by Headley and Griffith [17] who considered time, cost, quality and safety as primary goals while user satisfaction as secondary.

4.1 Success Criteria for Construction Projects

Bubshait and Almohawis [18] defined time as the degree to which the general conditions promote the completion of a project within the allocated duration. Naoum [19] and Chan [20] measured this criterion by time variation (overrun/underrun) and construction time respectively. In fact, the timing of major jobs may not always depend entirely on the physical condition of the element, but also on funding availability [21].

"Cost" was defined by Bubshait and Almohawis [18] as the degree to which the general conditions promote the completion of a project within the estimated budget. It was measured by Naoum [19] and Chan [20] as cost variation (overrun/underrun) and unit cost respectively. The cost variance of refurbishment projects is measured in terms of the ratio of actual construction cost to target construction cost [22]. The higher the involvement of the estimator during the construction stage, the lower the cost variance. El-haram and Horner [23] pointed out that maintenance costs should include all money spent on keeping the building up to an acceptable standard, namely direct (material, labour and plant) and indirect (administration, overhead and penalty) costs. While Al-Zubaidi [21] classified the cost of maintenance work into long-term, medium-term and short-term estimates, Yik and Lai [24] further classified the major cost elements into the costs of human resources, energy, consumables and spare parts. However, Rahmat et al. [22] criticized that the cost information is not only complex in nature but is also highly sensitive, which tends to fluctuate throughout the construction stage. The difficulty was further exemplified by Aouad et al. [25] who claimed that the life cycle cost (LCC) techniques are not widely used within the construction industry because of the problems associated with data capture, reliability and certainty.

Bubshait and Almohawis [18] defined "Quality" as the degree to which the general conditions promote meeting of the project's established requirements of materials and workmanship. The CIOB Report [26] also advocated that the completion of a maintenance project should meet both the quality and service standards. The former emphasized quality on products, skills of operatives, standard of supervision; quality assurance while the latter was assessed in terms of the time period or response time in which the work is to be completed. Shohet [12] also held that quality and cost are the measures for maintenance work, with quality relating to the response time to execute work requests together with time taken to return plant to service. Dessouky and Bayer [27] even warned that inevitable compromises in quality can result in higher costs during the usage phase of the project.

Safety is a particular important aspect of small works management since the works are carried out in occupied buildings where users are present [17]. Project participants need to secure safety performance in maintenance work, which has definite precedence over work for aesthetic or sustainable reasons [28]. Love and Edwards [29] believed that safety is a significant factor that contributes to project success, which can never be compromised. This idea was echoed by Fawcett and Palmer [30] who suggested that safety and risk should need particular attention when refurbishing an occupied building. Safety, represented as annual accident rate, was defined as the degree to which the general conditions promote the completion of a project without major accidents of injuries [18]. It, however, is not dealt with special attention in legislation for refurbishment work [16]. In fact, safety issues in maintenance projects will be intensified by the greater uncertainty and involvement of building users who may include the public. Therefore, the responsibilities for safety will also be more complicated than on a new-build site.

In addition to the CIRIA Report [16] which suggested aesthetic compatibility with the existing environment as secondary objectives, Headley and Griffith [17] considered user satisfaction as other importance success criteria for maintenance projects. For maintenance projects, Ulf and Ulla [31] believed that participants should consider business objectives, operational demands as well as health, safety and environment concerns. Sherwin [32] also pointed out that the latest additional objective for maintenance is to promote environmental sustainability and so modern maintenance management systems now generally include provision for safety and environmental legal requirements. On the other hand, Chanter and Swallow [33], and Love and Edwards [29] believed that it is necessary to examine not only traditional performance measures such as time and cost, but also the satisfaction levels of project team members. Bassioni et al. [34] further stressed that after project completion, what remains in the mind of participants is not so much concerned with financial success or early completion, but memories of harmony, goodwill and trust, or conversely, arguments, distrust and conflict.

4.2 Factors Contributing to Successful Project Performance

While success is the result of a construction process, it is necessary to determine the factors that lead to the ultimate outcome of a maintenance project. Success criteria correspond to the dimensions or measures on which the success of the project is judged whereas success factors are key variables that explain the success of the project [35]. Previous researchers have investigated the critical success factors (CSFs) for construction projects, which are the statements of how improved business practice must be achieved if an organization is to be able to attain its mission [36].

Beale and Freeman [37] developed a general project management model to explain what factors will affect the successful execution of a project. Later research focused on a more formal, systematic and sequential grouping of critical success factors. Naoum [19] cited project procedures as influential in affecting project success, like the effectiveness of control mechanisms and planning. As project-related factors are found to be critical in affecting project success, deeper research efforts were devoted to the field of project management actions on project success, such as the roles and influences of the construction leadership team [20]. Project participants and their interactive processes to form a committed team are also considered [38]. Subject to the dynamic environment, a construction project should be well managed by considering the external factors involved [39].

Similar factors have also been regarded as important for managing maintenance projects. It is essential to establish the organization's attitude to maintenance [33]. A culture should therefore be created within the business so that all the different functional units understand the importance of maintenance management [40]. Maintenance management also involves formulating and implementing maintenance strategies, and a comprehensive planned maintenance programme should be introduced [41,42]. The selection of procurement route is important to reduce the potential for disputes [17]. Those concerned with maintenance should have a wide knowledge and understanding of the buildings for which they are responsible [26]. Client requirements constitute the primary source of information for a construction project and are of vital importance to the successful planning and implementation of a project [43]. It is not sufficient to brief the project team, but the client needs to have a continuous and intimate involvement with the project [16]. An early involvement of the construction team with the design team should be encouraged.

Moreover, effective communication among all project participants is a prerequisite for the successful project management [44]. Clients and their project team members should communicate and work together harmoniously [29]. It is important to minimize confrontation and foster a cooperative and understanding attitude of mind between all parties to the project [16]. A contractor-client relationship where there is strong trust is indeed an ideal condition for maintenance operations [31]. Leung [45] even claimed that partnering workshops have proved to be an effective means of enhancing communication and promoting team building in maintenance contracts.

Following the recommendation of Collin [9], who suggests that KPIs should be "accepted, understood and owned across the organization", structured interviews have been arranged with the stakeholders, namely clients and contractors on the success criteria of maintenance projects.

5. Perspectives of Clients and Contractors on Success for Maintenance Projects

Apart from conducting the literature survey to provide a comprehensive knowledge base for the study of project success for maintenance projects, an empirical study has been conducted with ten participants of maintenance projects in the Hong Kong construction industry (Table 1).

Table 1: Details of interviewees

ID	Group	Title	Project type
Clt1	Client	Chief Building Surveyor	Residential
Clt2	Client	Senior Maintenance Surveyor	Residential
Clt3	Client	Project Manager	Commercial
Clt4	Client	Technical Secretary	Residential
Clt5	Client	Property Centre Manager	Commercial
Ctr1	Contractor	Senior Estimator and Asset Maintenance Manager	Civil works
Ctr2	Contractor	Director	School
Ctr3	Contractor	Manager	Commercial
Ctr4	Contractor	Contract Manager	Residential
Ctr5	Contractor	Contracts Manager	Commercial

The interviewees were labeled with prefix Clt- or Ctr- to represent client and contractor organizations respectively. Five came from the client group and five from the contractor group, who were chosen from the senior and middle management level in the local context. The interviews were conducted from June 2006 to July 2006 based on the following two questions as reported in the current study:

1. *What are the problems of running maintenance projects?*
2. *What do you think about the strategies to solve the problems?*

Tables 2 and 3 show the results of the interviewees on the criteria and factors of success for maintenance projects respectively.

Table 2: Success criteria for maintenance projects

Respondents	Time	Cost	Quality	Satisfaction	Safety	Environmental friendliness	Aesthetics	Functionality
Clt1	✓	✓	✓				✓	✓
Clt2	✓	✓	✓	✓	✓	✓	✓	✓
Clt3	✓	✓	✓		✓	✓		
Clt4	✓	✓	✓	✓	✓	✓	✓	
Clt5	✓	✓	✓		✓	✓		
Ctr1	✓	✓	✓	✓	✓	✓		✓
Ctr2		✓	✓	✓	✓	✓		
Ctr3	✓	✓	✓	✓	✓	✓		
Ctr4	✓			✓	✓			
Ctr5	✓	✓	✓	✓	✓	✓		
Total	9	9	9	7	9	8	3	3

Table 3: Success factors for maintenance projects

Respondents	Planning	Proper project management	Competent project participants	Effective communication	Clear client objectives	Cooperation among team members	Partnering and teamwork
Clt1	✓	✓	✓	✓			
Clt2				✓			
Clt3	✓	✓		✓	✓	✓	✓
Clt4		✓	✓	✓	✓		
Clt5	✓		✓	✓		✓	
Ctr1	✓	✓	✓			✓	
Ctr2		✓	✓	✓		✓	
Ctr3	✓	✓		✓		✓	
Ctr4	✓			✓			✓
Ctr5		✓	✓				✓
Total	6	7	6	8	2	5	3

Time, cost, quality and safety have been identified by the participants as the most important success criteria for maintenance projects (Table 2). Most client interviewees believed that the maintenance project should not only meet the satisfaction of the client

themselves, but also that of occupants and end-users who should provide positive feedback to the project team. Some contractor interviewees not just considered 'on budget' as the success criterion, but showed great concern on the generation of profit. One contractor even believed that the project can be regarded as success if the project team can acquire knowledge during management.

Both proper project management and effective communication have been considered by the practitioners as the most critical success factors for maintenance projects (Table 3). Such project management action includes budgetary and quality control monitoring systems. Effective communication is essential not just within the project team but also the end-users. Planning has also been considered important, including manpower, job sequence and procurement of materials. Project participants should be equipped with knowledge and experience such that mutual trust and team work can be created for smooth running of the maintenance project.

6. Conclusions

The quest for project success has resulted in a search of criteria and factors of success for construction projects. With the increasing attention on the performance management of existing building stock, this research investigates the criteria and success factors for maintenance projects. Findings suggest that most criteria and factors of success for new construction projects are also applicable to maintenance projects. Further research should be focused on the quantitative analysis of the success criteria and critical factors so that the participants of maintenance projects can allocate resources accordingly.

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