

Preliminary Qualitative Findings: Challenges in Large Infrastructure Projects Towards Development of Innovative Performance Measurement

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Abstract. Performance measurement system to assess development of large infrastructure project has developed due to the unachieved of high design and technical requirements, excessive cost investments and lack of competent human resources and managerial capabilities. Growing numbers of discrepant of interest among key participants has also led to conflicts, blame cultures, and mismatches of objectives that have been found to be contributory factors to poor project performance. Although, several approaches have been determined, the challenges in terms of time, cost, and quality (objective measures) are still arguable. Further exploration requires the inclusion of additional challenges in delivering large infrastructure projects, particularly in relation to subjective measures, such as safety, relationship, satisfaction, social and environmental aspects. Owing to this limitation, preliminary findings of identifying the challenges in large infrastructure projects are vital to fulfill the current needs in the development of innovative performance measurement. The research adheres to by reviewing relevant literature and evaluating expert insights on the research topic. The results of the research would provide qualitative evidence in support of the notion that appropriate and comprehensive performance measurement to improve project outcome. This study may also encourage key stakeholders mainly involved in infrastructure projects to increase their attention on possible challenges to achieve project objectives and requirements in the development of a large project, and helps to the achievement of government transformation programme (GTP).

Introduction

Construction industry makes a substantial contribution to the economic output of a country which it generates employment and income for the people. The construction industry has strong linkages with many economic activities that directly and indirectly influences other industries and ultimately, contributes to the wealth of country [1]. This shows that construction industry contributed significantly to the Malaysian economic sector. This helps Malaysian Government to achieve the growing demand of infrastructure in the country [2]. Large infrastructure project needs a good quality in managing resources in soaring the project are delivered successfully [3]. However, there are several challenges in delivering large infrastructure projects particularly in terms of safety, relationship, satisfaction, social and environment that need to be concerned as this area is still undefined clearly. Besides, other aspects of project management that are also found to be challenging such as quality, cost and project schedule. These three aspects are interdependent in the achievement of project success.

Large infrastructure project and performance measurement in construction projects

Large infrastructure projects are defined as complex, risky and time-consuming undertakings that are usually the projects that commissioned by governments and delivered by national and international participants. In the implementation of the large infrastructure projects, there are numerous of cultural differences, namely backgrounds, political systems and languages [4]. The barriers need to be concerned as it potentially leads to low project quality. Large infrastructure is the basic physical systems of a business or nation such as transportation, communication, sewage, water and electric systems. Primarily, large infrastructure projects are covered by the high cost over in construction projects compare to small and medium construction projects [5]. The implementation of large infrastructure requires a high design knowledge and technical skills, competent human resources, professional managerial capabilities and large scale of investment [6] [7] [8]. Towards assisting governments to achieve project objective, this paper aims to determine challenges in delivering large infrastructure projects particularly in using of innovative performance measurement methods that will be discussed in the following sections.

The evaluation of performance measurement has seen a shift in focus from objective measures of measurement to subjective. It should be noted that the objective approach uses mathematical calculations based on construction time, speed of construction, cost, and accident rate, while the subjective approach uses participant opinions and personal judgment. The usage of subjective measurement seems widely accepted as the method more comprehensive. The concept of satisfaction measurement has been developed in the construction industry as a performance measurement only in recent years. This approach has been used increasingly as an indicator of performance level, particularly in gauging project and participant performance.

Challenges of Large Infrastructure Projects

In recent years, there has been rapid growth of the industry in Malaysia [9]. Although a lot of money has been spent in construction, the industry is still facing a lot of challenges such as delay to complete the project on time, expenditure exceeding the budget, construction defects and dependency on foreign workers [10]. Besides, the other challenges that facing in construction industry is performance. The low confidence and falling public investment are limiting output and employment growth. Competence is also seen as another prerequisite for the success of construction projects. The challenges are include utilization of up-to-date technology, proper emphasis on past experience, multidisciplinary/ competent project team, and awarding bids to the right designer/contractor. Large construction projects require certain levels of technology, but selecting the right technology may be problematic, especially when the project team is incompetent. There are seven challenges have been determined from previous study [11] namely public perception, tendering problems, designing, financial, human resources, productivity, material and technology.

Methodology

Research methodology refers to the principles and procedures of logical thought processes which apply to a scientific investigation [12]. Method concerns the techniques which are available and those which are actually employed in a research project [13]. It has been set up in order to achieve the aim of this paper. Literature reviews were conducted to gain information on large infrastructure project development in Malaysia in terms of challenges, importance and its performance. To have a broader understanding on large infrastructure implementation, this research also involved series of face-to-face interviews method which were carried out with construction industry players. Interview sessions were involved ten experience respondents that were purely selected from civil engineering background. The respondents were basically asked through a valid instrument on the main challenges in delivering large infrastructure project.

Data Analysis and Discussion

Based on data collection, it shows that majority of the respondents participated in the interviews are experienced person. Table 1 indicates the respondents according to their position, background, experience, and type of project undertaken. Ten (10) respondents were interviewed from different companies that currently undertaking large infrastructure projects throughout Malaysia.

Tab. 1. Details of Respondents

Respondent	Position	Background	Experience	Type of Project
R1	Assistant Director	Masters in Civil Engineering	20 Years	University
R2	Assistant Director	Degree in Civil Engineering	18 Years	University
R3	Civil Engineer	Degree in Civil Engineering	10 Years	Building
R4	Civil Engineer	Masters in Civil Engineering	10 Years	Water front
R5	Engineer	Degree in Civil Engineering	5 Years	Residential
R6	Project Engineer	Professional Engineer (Ir)	17 Years	University
R7	Civil Engineer	Degree in Civil Engineering	6 Years	Electric Power Station
R8	Project Engineer	Degree in Civil Engineering	11 Years	Road Construction
R9	Project Engineer	Degree in Civil Engineering	13 Years	Road Construction
R10	Civil Engineer	Degree in Civil Engineering	6 Years	Residential

Data collected from interview was analyzed using content analysis. This procedure was used to find out the main challenges that faced by contractors in Malaysia. The respondents were coded as R1 to R10. Several questions in regards to the challenges in large infrastructure implementation were designed and used in the data collection. Table 2 shows the summary of thirteen (13) main challenges (gathered from literature reviews) that typically faced by the contractors in delivering large infrastructure projects.

Tab. 2. Elements of Interviews

Elements	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10
Project Planning	√	√	√	√	√	√	√	√	√	√
Tendering	X	√	√	√	√	X	√	√	√	√
Relationship	√	√	√	√	√	√	√	√	√	√
Technology	√	√	√	√	√	√	√	√	√	√
Specialist/Expertise	√	√	√	√	√	√	√	√	√	√
Communication	√	√	√	√	√	√	√	√	√	√
Safety and Health	X	√	√	√	√	√	√	√	√	√
Scope Project	√	√	√	√	√	√	√	√	√	√
Duration of Construction	√	√	√	√	√	√	√	√	√	√
Certificate Practical Completion	X	√	√	√	X	X	√	X	√	X
Financial	√	√	√	√	√	√	√	√	√	√
Public Perception	√	√	X	√	X	X	√	X	X	√
Maintenance	√	√	√	√	√	√	√	√	√	√

Content analysis determines thirteen elements derived from the interviews can be grouped into two groups. Further discussions on the two groups are as follows:

- **Group 1 (Most significant challenges)**

This section discusses the most significant challenges in large infrastructure projects. Majority of the respondents agreed that project planning, technology, specialist, communication, scope project, duration of construction, financial and maintenance are the main constraint in large infrastructure project implementation. This means that contractor needs a detail and clear project planning that comprises of information in terms of scope of work, time, financial and maintenance works. Additionally, the result also indicates that requirements of complex technologies and competent specialists in the project implementation are highly needed to be concerned in improving project quality. Communication is also found to be a very important factor to contractor in project execution. From the interviews, several companies highlighted that communication teams are created in the project to ensure the information can be managed in large infrastructure projects.

Previous research also supported that lacking of effective communication may lead to the work failures and affects the project performance [14]. Interpersonal relationship is also needed as it has positive impacts on the communications patterns that influence the successful implementation in construction industry. Strong interpersonal relation among the construction players also significant requirements in organizations [15]. This means that challenges in terms of developing interpersonal relationship among construction players need to be concerned constantly.

- **Group 2 (Moderate significant challenges)**

Data from the interviews revealed that two challenges are found moderately significant in large infrastructure projects. The challenges are namely certificate practical completion and public perceptions. These two items are a part of the completion stages in construction phase. This shows that practical completion of a project is of huge commercial significance as its occurrence fundamentally changes the rights that exist not only between the parties to the building contract but amongst third parties too, such as tenants and purchasers. Besides, findings also asserted that contractor has less issue in obtaining certificate of practical completion. Fulfillment all requirements needed is significant in attaining CPC to be issued in timely manner. Interestingly, the results from interview show that public perceptions may not significantly influence the implementation of large infrastructure projects. Majority of the public are more concern on the function of final outcome (MRT, roads, bridges and dam) rather during the implementation.

Framework of Challenges Large Infrastructure Projects

Based on the findings, this section attempts to develop a preliminary framework of challenges in large infrastructure projects. The framework consists of three main stages namely challenges at initial, construction and completion. Several challenges under first stage are tendering, project scope and project planning. This means that contractors need to increase their competitiveness in procuring infrastructure projects. Commonly, infrastructure project requires a high complexity and advanced technologies. Therefore, contractor needs a clear project scope and a proper project planning. Second stage of the framework is safety and health issues, expertise, relationship, communication, and financial. It is important to note that project delay, loss of capital and revenue, and poor project performance can be avoided by concerning these challenges extensively prior the construction. Finally, the third stage is challenges at completion stage. Most of the respondents agreed that maintenance works is considered as the main challenges in large infrastructure projects as it may needed an extra cost and highly expertise. Figure 1 depicts the framework in regards to the challenges in large infrastructure project in Malaysia. The elements in this framework would be useful in enhancing current performance measurement tools.

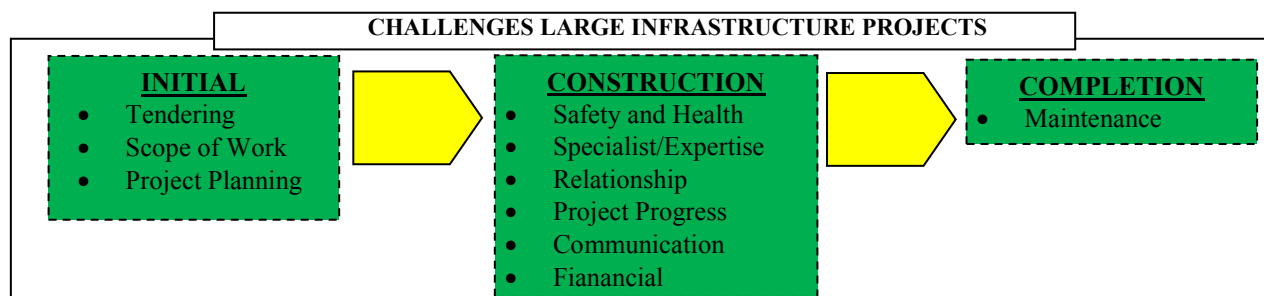


Fig. 1. Framework Challenges in Managing Large Infrastructure Project Based on Interviews

Conclusion

This section concludes a preliminary framework proposed in this paper as shown in Figure 1 is integrated between three main stages (initial, construction and completion). This framework would be useful in enhancing the existing performance measurement. Additionally, thirteen challenges of

large infrastructure projects that are grouped in three main stages of construction phases are likely to be important in enhancing and improving project performance. Further study is necessary to determine the most significant challenges through a systematic analysis as this paper is purely discussed on the preliminary qualitative findings of the study. This study may also encourage key stakeholder who involved in infrastructure projects to increase their attention in mitigating challenges as it may useful in the achievement of government transformation programme (GTP).

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