

Assessing the Risk Level of the Challenges Faced In Construction Projects

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Abstract-The failure of construction projects could be attributed to several challenges that emerged during the construction process. Nine major challenges were uncovered from the literature: resource allocation, time, cost, quality, safety, project complexity, changes, uncertainties, and communication. A survey was carried out among professionals having a minimum of 10 years of experience in the construction industry to identify the occurrence and severity of these challenges. A total of 117 responses were analyzed and plotted on a risk matrix. The mean values indicated that time, cost, and quality are the top three challenges faced in construction projects, while the risk matrix revealed that all challenges are high-risk challenges. Thus, the professionals should consider suitable measures to address these challenges for improving a project's performance.

Keywords-construction industry; construction challenges; risk; risk matrix; Malaysia

I. INTRODUCTION

The construction industry is considered a key industry in a country's development and contributes 18% of the worldwide GDP [1]. The construction industry is referred to as vibrant due to uncertainties in technology, budgets, and development processes [2]. The operations of the construction industry require sufficient labor force, skills and commitment, and effective manpower organization [3]. Conventionally, the performance of a construction project is assessed based on three parameters i.e. time, incurred cost, and quality [4-6]. Other studies have stated that the performance also includes safety as an additional criterion [7-9]. Once the project size becomes larger it is becoming more challenging, especially during the implementation stage and thus it will likely disrupt the targeted performance [10]. To deal with this challenge, specific skills, expertise, experience, and knowledge are needed to avoid any potential project overruns [11]. Several approaches have been introduced to address these challenges, and leadership is one of them [12]. Failure or success of construction projects highly depends on the ability to handle

challenges that emerge along with the construction processes. For this, the knowledge of the challenges occurring in construction projects is essential. This study aims to investigate the various challenges faced in construction projects and to assess the level of risk for each of them.

II. IDENTIFICATION OF CONSTRUCTION CHALLENGES

Challenges are inevitable in a construction project and impact its performance. These challenges may emanate from improper communication among the staff, low quality workmanship, and insufficient amount of materials available [13]. Moreover, the organizational drawbacks and the incapability to deal with critical situations also fuel these challenges [14]. This study investigated the constraints faced by construction leaders to keep the project well organized and running smoothly, ensuring its successful completion.

In [15] the challenges were classified into construction issues and peripheral pressures. In [16] the challenges were classified into 4 categories: engineering, human development, managerial and political, and sustainability challenges. Seven construction management challenges were pointed out in [17]. Financial constraints and awareness & knowledge were identified as two major challenges of the construction field in [18]. In [19], three project challenges were pointed out: late approvals, sudden changes of rules, and non-uniform compliance. In [20], the challenges in construction practices were abridged to resource allocation, scheduling and budget management, meeting the quality and safety standards, maintaining complexity, organization management, change management, risk and uncertainties management, and communication system. In [21], the challenges were classified into resource management, risks and uncertainties, support from top management, and restraint of budget. In [22], uncertainty, bad worker attitude, financing matters, contractor selection, and adoption of the latest technology and advanced techniques were pointed out as major construction challenges.

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Moreover, claim challenges are faced by every contractor in the construction project [23]. A literature review highlighted the nine common challenges faced in construction works shown in Table I.

TABLE I. CHALLENGES FACED IN CONSTRUCTION PROJECTS

Challenges in construction projects	References
Resource allocation	[24-29]
Time	[30-33]
Cost	[33-38]
Quality	[39, 40]
Safety	[41, 42]
Project complexity	[43, 44]
Changes	[45, 46]
Uncertainties	[24, 47-49]
Communication	[50-52]

A. Resource Allocation

Construction activities depend on the availability of resources [53]. Resource management is essential to achieve the success of any project [54]. Resources in the construction project usually consist of labor, materials, machines, and money [55]. The success of infrastructure and megaprojects needs a high amount of financial and human resources [56]. Resources should be properly allocated due to limited availability and high demands in the construction industry, while all resources are equally important. Construction materials typically contribute about 40-45% to the total cost of a project [57, 58]. Hence, appropriate planning is crucial to ensure the timely availability of adequate and suitable materials [59]. Planning the construction project manpower is important for determining the size of the project workforce, organizing into functional groups, and hiring suitable manpower [58, 59]. Construction machinery contributes about 20-30% to a project's cost, with additional costs for maintenance, repair, and operation. Resource planning also ensures the availability of adequate and suitable equipment [59].

B. Time

Construction time is a major concern, as each project has a predetermined period with a definable beginning and an identifiable end. Inefficient time management increases a project's cost, spoils a company's reputation, and reduces construction productivity [55].

C. Cost

The construction process is capital intensive due to the large amounts incurred at every project stage [29]. The cost of labor, materials, equipment, professional fees, and total profit are major components of a project's cost. Cost management can be affected by capital shortages, impractical profit margin, high debits, and improper management of resources [37]. Besides, cost escalation is also a ubiquitous issue faced in construction projects [60].

D. Quality

Quality is defined as meeting the legal, aesthetic, and functional requirements of a project [61]. Quality problems cause delays and cost overruns. Effective quality management

increases product quality, improves workmanship and efficiency, decreases wastage, and increases profit [62]. Quality is an essential consideration in selecting the proper contractor for any project [63].

E. Safety

Safety is a major concern in the success of the construction industry, especially when considering work-related accidents [64]. Safety measures account for 1-2% of the total contract cost in a construction project [58]. Safety management issues in a construction site depend on workers' attitudes [65].

F. Project Complexity

Project complexity involves the employment of individuals from different organizations and combinations of technology [66]. Project complexity has a direct relation with uncertainty in the term of its element [67].

G. Changes

A change in a construction project is an alteration or a modification in the pre-existing conditions, assumptions, or requirements [68]. It occurs when the scope of work differs from the scope of the work outlined in the contract documents [69]. Changes in construction affect delivery time and cost significantly [69-70].

H. Uncertainties

Uncertainty is the chance of any event with a genuinely unknown probability distribution [71]. The ambiguity of a project's uncertainty is considered a threat to construction performance [72]. Managing uncertainties involves risk and opportunities, where the activities and processes could become worse or better than planned [73].

I. Communication

Previous studies indicated that over 50% of construction projects were unsuccessful due to poor or insufficient communication [74]. The complex communication environment in large or mega construction projects requires frequently changing sets of relationships [50].

III. DATA COLLECTION AND ANALYSIS

This study performed a quantitative survey on the perceptions of various professionals engaged in handling construction projects. It aimed to uncover the possible challenges in the construction industry and identify their respective level of risk. Professionals' perceptions were collected utilizing a structured questionnaire. Data analysis involved statistical methods using mean score calculation with the formula adopted by [75]:

$$M = \frac{\sum(X)}{N} \quad (1)$$

where M is the mean, X are the individual data points, and N is the sample size (number of the data points).

The risk level of the challenges was assessed based on the risk matrix. A risk matrix is a tool to assess the risk level using a graphical representation based on two axes: the level of severity and occurrence. A 5-point scale was used for each axis, as shown in Table II: 1-very low, 2-low, 3-moderate, 4-high, and 5-very high. The factors could be classified based on

risk level or using a risk matrix where the factors are placed based on occurrence and severity levels and assessed accordingly. This study utilized the risk matrix to assess the risk category of construction's challenges. Based on the two parameters and the scale, the drawn risk matrix can be seen in Figure 1 [76].

TABLE II. MEASUREMENT SCALE

Scale	Level of Severity	Frequency of Occurrence/likelihood
1	Very Low (VL)	Very Low (VL)
2	Low (L)	Low (L)
3	Moderate (M)	Moderate (M)
4	High (H)	High (H)
5	Very High (VH)	Very High (VH)

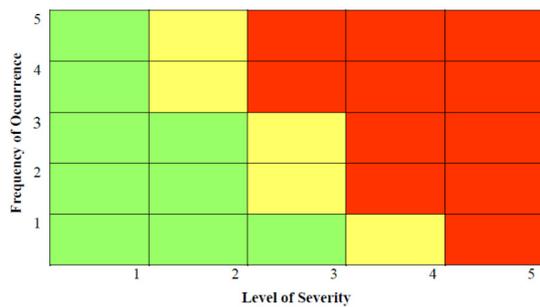


Fig. 1. Risk matrix.

The risk matrix is divided into three zones:

- Green zone: Risks are of low level and can be ignored.
- Yellow zone: Risks are of moderate importance and should be controlled.
- Red zone: Risks are of critical importance. These are the top priorities and close attention should be paid.

IV. RESULTS AND DISCUSSION

A total of 117 completed questionnaires were collected throughout Peninsular Malaysia. Data collection was performed through an in-person/site visit (face-to-face) approach.

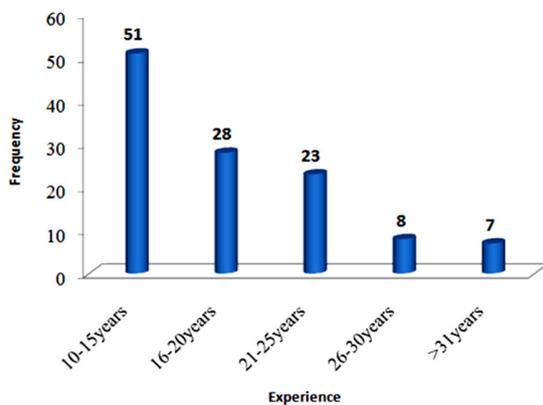


Fig. 2. Respondents' experience.

Initially, an appointment was set with the respondents to participate in a telephone interview and an e-mail survey. On the agreed date, the respondents were approached and a short briefing was given about the study's purpose and the contents of the questionnaire. The survey was completed in 3 months. The respondents were professionals with experience in several project types and sizes. A summary of the respondents' project experience and size is shown in Figures 2 and 3 respectively.

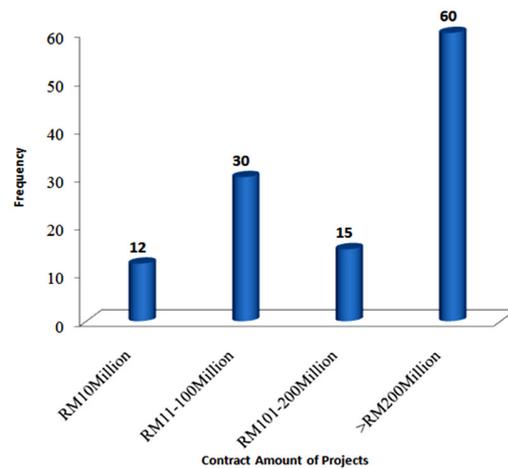


Fig. 3. Size of the projects participated.

Respondents' experience is a very crucial parameter as they could provide better judgment on the challenges and the required leadership characteristics due to their long-time involvement. From Figure 2, it can be noted that the minimum experience of the respondents was 10 years while 38 respondents were working for more than 20 years in the construction industry. This indicates that the participants were capable enough to provide insight views of the problems faced in construction. The respondents were handling projects of several sizes. The minimum size of the projects handled by respondents was RM 10 million, while the majority was engaged in projects with more than RM 200 million contracts. Collected questionnaires were checked for reliability to assess their consistency. Cronbach's alpha value was computed to check the internal consistency, which ranges from 0 and 1, where 1 means that the data are highly reliable and valid while 0 means the opposite [77]. In this study, Cronbach's alpha value of data for severity level was found at 0.851, and the same for occurrence level was found as 0.844. As these values are higher than 0.6, they are deemed suitable for further analysis as suggested in [78]. The mean values of the responses on the occurrence and severity levels of construction challenges were calculated, and the results are shown in Table III. From Table III, it can be observed that time challenge is the most commonly occurring and severe challenge in construction projects of Malaysia, as it was also shown in [79]. The second major challenge was the cost of the construction project. Cost is a very serious issue and is given the highest priority by the owners and subsidizers. Many researchers have emphasized that cost must be given a high priority. Quality was reported as the third major challenge from the occurrence point of view, while from the severity perspective it was reported as fourth.

On the contrary, the practitioners reported safety as the fourth and third major challenge from the occurrence and severity aspects respectively. The mean values of all challenges were plotted on a risk matrix, as shown in Figure 4.

TABLE III. LEVEL OF OCCURRENCE AND SEVERITY OF THE CHALLENGES

S.No	Challenges in handling the construction projects	Frequency of occurrence	Level of severity
1	Time	3.67	3.48
2	Cost	3.51	3.29
3	Quality	3.44	3.19
4	Safety	3.33	3.24
5	Resources allocation	3.29	3.09
6	Changes	3.19	3.08
7	Uncertainties	3.15	3.06
8	Project complexity	3.03	2.84
9	Communication	3.13	2.83

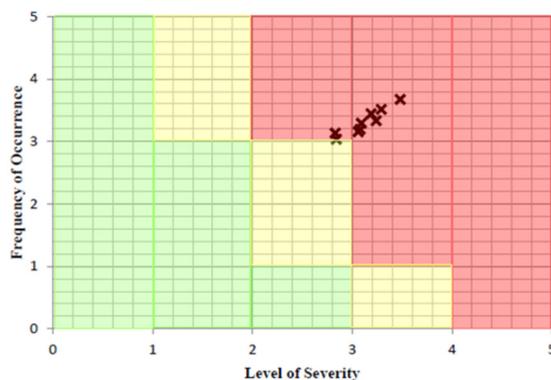


Fig. 4. Risk level of the challenges.

Figure 4 illustrates the 9 challenges marked with "x" on the risk matrix. Since all marks are located in the red zone/region, it indicates that all challenges belong to the high-risk category. The challenges need to be addressed carefully by the construction leaders during the implementation of a project. Hence, appropriate measures should be considered to handle these challenges successfully. One of the appropriate ways for controlling these challenges is effective leadership. Leadership can be used effectively by adopting several characteristics such as imparting information effectively, knowledgeable, work according to the plan, setting priorities, and willingness to take responsibility [80].

V. CONCLUSION

Every construction project faces unavoidable challenges. The level and effects of a challenge might vary from project to project as well as from region to region. This study focused on examining the various challenges faced in construction projects of Malaysia through a questionnaire survey among experienced practitioners. These challenges included resource allocation, time, cost, quality, safety, project complexity, changes, uncertainties, and communication. Statistical analysis revealed that all investigated challenges were high-risk challenges. The practitioners reported that time, cost, and quality were the most critical challenges. The practitioners need to take the necessary

measures for avoiding time, cost, and quality problems that could fail a construction project.

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