Critical Success Factors for Malaysian Contractors in International Construction Projects using Analytical Hierarchy Process

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Abstract

Construction projects are currently progressing slowly around the world as a result of the recent global economic crisis. In order to accommodate public needs within the current economic situation, the Malaysian Government has restricted the procurement of public sector projects to "necessary to meet public need" projects only thus narrowing the number of domestic projects available. Consequently, most major contractors have decided to change their focus by looking into international projects outside Malaysia not only to ensure the viability of their businesses but also for long-term survival. Although some Malaysian contractors have managed to penetrate successfully into international construction projects, their critical success factors (CSF) are purely unknown. This paper aims to determine the CSFs and provide some guidance for contractors interested in tapping international markets. This investigation is based on interviews with project managers, directors and key executives from Malaysian construction and engineering firms that have established an excellent reputation and worldwide success in the last decade. The CSFs are then presented in the form of AHP priority-ranking model, which prioritizes the success factors identified in sequential manner, from the most up to the less critical ones. The establishment of this kind of priority-ranking model enables contractors in Malaysia to not only identify the key elements or factors that need to be thoroughly considered and managed but also allow them to prepare appropriate mitigation strategies and contingency plans prior to entering into international construction projects.

Keywords: AHP, Critical Success Factors, Malaysian Contractors, International Construction

Introduction

The Malaysian construction industry constitutes an important element in the total Malaysian economy. Even though it accounts for only less than 5% of Malaysian Gross Domestic Product (GDP), the construction industry is a strong growth push factor because of its extensive linkages with other sectors. It includes activities ranging from construction of buildings, roads, electricity or other transmission lines or towers, pipelines, oil refineries to other specific civil engineering projects (CIDB, 2007). (Ngowi et. al, 2005) described international construction where a company, resident in one country, performs work in another country. According to (Maznah, 2006), the international construction sector consists mainly of contractors that are based in the major industrialized countries but have operations in a number of countries. Malaysian construction companies are revisiting their expansion strategy to include the international market and to position themselves globally and have successfully penetrated the construction markets in the Gulf Countries, India,

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ASEAN and Africa. As at December 2010, 108 contractors have acquired construction contracts worth RM89,192 million in over 40 countries. It comprises of 548 completed projects valued at RM49,953 million and 80 ongoing projects valued at RM39,238 million (CIDB, 2010). Among the experienced overseas Malaysian contractors, three have been identified as having a significant international exposure – WCT Engineering with more than 65% of overseas projects, followed by IJM (55%) and Gamuda (38%) (Morgan, 2008).

(Maznah, 2006) pointed out that globalization of construction markets on one hand, bring along challenges in the form of greater competition, while on the other form, provides very huge opportunities by opening up new markets. There are several reasons considered by construction firms when they decide to venture into the foreign market. Market expansion is one of the strategies reasons behind any company's movement into the international market. (Maznah, 2006) also stated that the decision taken by Malaysian construction companies to expand their business into international markets include the stagnant condition of domestic markets, spreading risk through diversification into new markets, competitive use of resources and taking advantage of the opportunities offered by the global economy. In addition, (Ragayah, 1999) mentioned that the major reason for Malaysian construction companies investing abroad is to expand and to find new markets for growth. Promoting their expertise overseas also gives global contractors a competitive edge over their rivals (Abdul-Aziz, 1994). Consequently, most of the major Malaysian contractors have decided to change their focus by looking into international projects outside of Malaysia not only to ensure the viability of their businesses but also for long-term survival i.e. Veritas Architects Sdn. Bhd (Hashim, 2008), IJM, WCT Engineering and Gamuda (Morgan 2008).

Malaysian investments in the Asia Pacific Region and in other new emerging economies have also been growing significantly. Thus, Malaysian contractors are taking the cue and this is another reason why there are many construction firms slowly looking for opportunities to invest abroad as well. The Malaysian Government has organized various trade missions to other countries in order to encourage local companies to venture into these foreign markets. However, local investors who wish to venture their business into the international markets are very likely to face challenges upon entry into a new overseas market. The challenges that they may potentially face would be cost, foreign government policies and the establishment of a 'joint venture' type of partnership. Therefore, choosing the right entry mode strategy is a very important decision as it will determine the survival of the company in the foreign country (Andersen and Strandskov, 1998). (Domke – Damonte, 2000) also explained further that by choosing the right entry mode strategy when venturing internationally, it will be able to help the firm to identify and adjust its resources in the long run, as it attempts to generate a sustainable competitive advantage in the foreign market. According to (Mawhinney, 2001), in order for a company to choose an effective entry mode strategy into a foreign market, construction firms must first evaluate the potential future market in a particular foreign country. For a company to continue to make profits and sustain their growth, it is very crucial for it to conduct a thorough research before making the decision to enter into a totally new foreign market.

Research objectives

The research work reported in this paper is part of an on-going research project for a Masters degree. Malaysian construction companies which have gone overseas were the subject matter of this study. Records obtained from the Construction Industry Development Board (CIDB, 2010) show that from 1 January 1986 up until 31 December 2010,

Malaysian contractors had completed 548 overseas projects to the tune of USD25.5 billion (using exchange rate of USD1 = RM3.50). Relatively speaking, they are still new in international contracting compared to those from traditional contracting nations from Western Europe, North America and Asian countries such as Japan and Korea.

Thus, the identification of CSF and their ranking for international construction project success throughout this research hopes to enable them to properly allocate limited resources and better predict the possibility of success if they decide to expand their operations overseas. The purpose of this research is to: (1) identify reasons that trigger the internationalization of Malaysian contractors; (2) identify the critical success factors needed for them to operate overseas; (3) classify and rank those CSF that will enable them to enter into overseas construction markets. The research objectives were met by the accomplishment of several specific tasks. The following research tasks were completed:

1. Define the criteria for project success
2. Identify the critical success factors (CSF) affecting project success
3. Collecting the data
4. Developing the AHP model
5. Use model to analyze the data
6. Rank the CSF of international construction projects

1. Criteria for project success

No single list of criteria is totally comprehensive when it comes to a definition of success for a project. Indeed, measuring project success is a complex task since success is intangible and can hardly be agreed upon. The general concept of project success remains ambiguously defined because of varying perceptions. Such a phenomenon also exists in the construction industry where so many different parties are involved, including the client, the architect, the contractor, the design team and various surveyors and engineers. Each project participant will have his or her own view of success (Sanvido et al., 1992). Moreover, the definition of success often changes from project to project depending on the participants, scope of services, project size, project complexity and a variety of other factors.

2. What are Critical Success Factors (CSF)?

(Rockart, 1982) defines critical success factors as those few key areas of activity in which favourable results are absolutely necessary for a particular manager to reach his or her own goals … those limited number of areas where "things must go right". (Smith and Walker, 1994); (Tiong, 1992); (Turner, 2002) define CSFs as those factors in which success is necessary in order that each of the major projects participants in a project has the maximum chance of achieving the goals.

The CSF methodology according to Rockart's research is a procedure that attempts to identify factors vital to the success of the industry, organization or the individual's work. Rockart's methodology consists of identifying key goals from the organization's strategies and objectives. From these, factors are determined which are critical to obtaining the identified goals. The procedure begins by conducting interviews with senior management using the "CSF interview process". Each interview begins with the interviewer outlining the concept and methodology of CSFs; the interviewee then describes the company's mission and the role that they play in the company. Following a discussion of the interviewee's goals, CSFs are developed which are designed to best facilitate the interviewee in meeting their goals. General indications are then sought as to how the

interviewee would prioritize the identified CSFs before attempts are made at determining suitable measures for each CSF. The collective sets of CSFs from all interviewees in the organization are reviewed to check for areas that some interviewees may have failed to cover, this collective set of factors is then analysed to identify the general areas considered as critical for success (Owen, 2003).

Following semi-structured interviews with construction professionals from international Malaysian contractors and a thorough literature review search, 40 CSFs were identified and grouped under seven main categories: (1) Project Management Factors; (2) Procurement related Factors; (3) Client-related Factors; (4) Design team-related Factors; (5) Contractor-related factors; (6) Project Manager-related Factors; and (7) Business and Work Environment-related Factors. These seven categories cover every critical element that has an impact on international construction projects.

2.1. Project Management Factors

Project management action is a key for project success (Hubbard, 1990). (Jaselskis and Ashley, 1991) suggested that by using management tools, project managers would be able to plan and execute their construction projects to maximize the project's chances of success. The variables in project management include adequate communication, coordination effectiveness, decision making effectiveness, project monitoring, appropriate organization structure, related previous management experience and overall managerial actions (Belout, 1998; Chua et al., 1999; Walker and Vines, 2000).

2.2. Procurement-related Factors

A number of researchers identified the importance of procurement factors (Pocock et al. 1997a, 1997b; Kumaraswamy and Chan, 1999). (Dissanayaka and Kumaraswamy, 1999) defined the scope of procurement as the framework within which construction is brought about, acquired or obtained. Therefore, three attributes are used to measure this factor; they are the procurement method (selection of the organization for the design and construction of the project), tendering method (procedures adopted for the selection of the project team and in particular the main contractor) and contracting mechanism (type of contract).

2.3. Client-related Factors

(Chua et al., 1999) defined project participants as the key players, including project manager, client, contractor, consultants, subcontractor, supplier, and manufacturers. (Walker, 1995) considered influence of client and client's representative as a significant factor on construction time performance. The client related factors are concerned with client characteristics such as client's experience, client confidence in the construction team, owner's construction expectations, well-defined scope and objectives, owner's risk aversion, client project management, client ability to brief and ability to make timely decisions (Chan and Kumaraswamy, 1997; Songer and Molenaar, 1997; Dissanayaka and Kumaraswamy, 1999).

2.4. Design team-related Factors

Designers play a vital role as their work involves the inception to completion of a project. (Chan and Kumaraswamy, 1997) considered that design team-related factors consist of design team experience, project design complexity, and mistakes/delays in producing design documents. Other attributes include adequacy of plans and specifications and contribution to the overall construction process.

2.5. Contractor-related Factors

The main contractor and subcontractors start their main duties when the project reaches the construction stage. The variables include contractor experience, site management and supervision, involvement of subcontracting, contractor's cash flow and speed of information flow (Chan and Kumaraswamy, 1997; Dissanayaka and Kumaraswamy, 1999).

2.6. Project Manager-related Factors

The project manager is another key stakeholder in a construction project and his competence is a critical factor affecting project planning, scheduling, and communication (Belassi & Tukel, 1996). Variables under this factor consist of the skills and characteristics of project managers, their commitment, competence, experience, and authority (Chua et al., 1999).

2.7. Business and Work Environment-related Factors

Various researchers support ''environment'' as a factor affecting the project success (Akinsola et al., 1997; Songer and Molenaar, 1997; Chua et al., 1999; Walker and Vines, 2000). (Akinsola et al., 1997) further described ''environment'' as all external influences on the construction process, including social, political, and technical systems. The attributes used to measure this factor are economic environment, social environment, political environment, physical environment, administrative approvals, sufficient funding, technology and skill availability and commitment of all parties involved.

Research methodology

As mentioned above, the primary data is gathered from in-depth interviews with key directors, project managers and executives from selected construction firms which have gained significant success overseas. In addition to the primary data, the study also uses secondary data that is extracted from various sources such as the companies' annual reports, paper clippings, magazines, and the statistical reports from government related agencies. Another source of secondary data is also obtained from a thorough literature review of journals, conference paper proceedings and theses. Analyzing secondary data provides insight into the various factors that encourage Malaysian contractors to go abroad, their entry methods as well as activities conducted by their respective firms. The proposed method implemented to evaluate the CSF in this study is based on a multi-criteria decision making tool (MCDM) called the analytical hierarchy process.

Analytical Hierarchy Process (AHP)

AHP is one of the most popular methods used in multi-criteria decision making MCDM processes. (Saaty, 1980) defines the AHP as a decision method that decomposes a complex multi-criteria decision problem into a hierarchy. One of the main benefits of the AHP is its relative ease in which it handles multiple criteria. AHP allows the decision maker to model a complex problem into a hierarchical structure which consists of the goal, objectives (criteria), sub-objectives and alternatives. The reason of using AHP is that the CSF in construction projects are based on viewpoints and experiences of experts which is mostly qualitative in nature that would otherwise be difficult to take into consideration; and the second reason is the structure of the hierarchy. The problem is broken down into its constituent parts going down the hierarchy from large elements to small elements. Such a structure clarifies the problem and exhibits the contribution of each of the elements to the final decision.

Applying the AHP method

After establishing the most critical success factors from the interview process and literature review, the AHP is used to analyze and rank these factors. The design of the AHP hierarchy must satisfy the goal of developing a model that will allow the decision maker to determine and rank the CSF for international projects. This is done using Expert Choice, a computer software package that structures the decision into criteria and sub-criteria, measure the criteria and sub-criteria using pair-wise comparisons, and then synthesize those criteria and sub-criteria to develop an overall priority ranking. The hierarchy developed in this study consists of three levels. The first level represents the goal of determining the CSF from the most critical to the less critical ones. The second level in the hierarchy is represented by the various factors identified and the third level represents their sub-factors. Figure 1 illustrates the required steps to be taken in this paper.

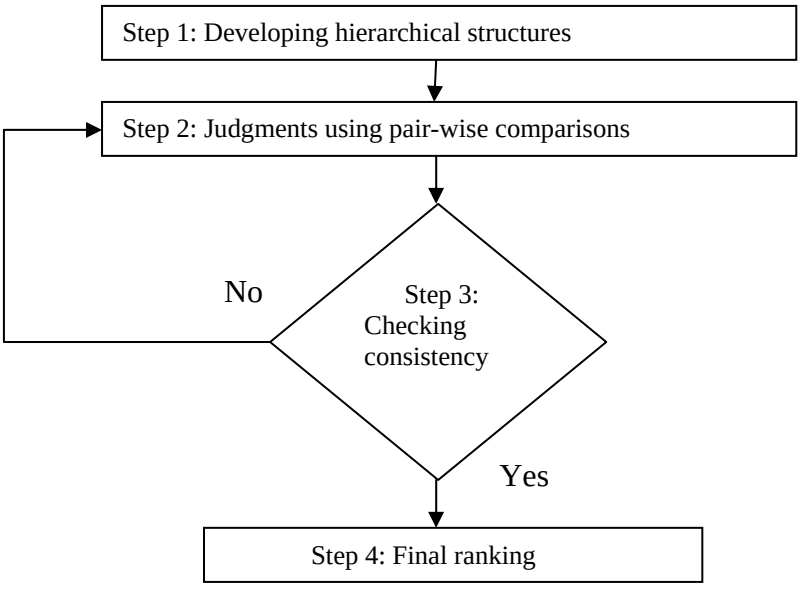

Figure 1. Stepwise AHP procedure

Stepwise procedure of the AHP methodology

Step 1: Developing hierarchical structures

The first step in AHP is to develop a hierarchical structure to define a single pre-defined goal and potential sub-criteria supporting each criterion. Figure 2 shows the proposed hierarchical tree to prioritize and evaluate the CSFs. The identified CSFs are categorized in 7 main groups and a hierarchy structure of their sub-factors is provided.

Figure 2. Hierarchical structure of CSFs

Step 2: Judgments using pair-wise comparisons

Once the model is set up, the local priorities or weights need to be developed. These weights are assigned to each criterion and sub-criterion through a process called pair-wise comparison by the expert. In pair-wise comparison, each criterion is compared at a peer level in terms of importance and judgments are elicited from the expert. The Expert Choice software provides ratings to facilitate these judgments. One of the comparisons that can be done is by verbal comparison. Decision makers compare criteria for their relative importance using words such as Equal, Moderate, Strong, Very Strong and Extreme. For example, while evaluating the criteria the decision maker should ask 'How important is the project management related factor compared to the project manager related factor?' The answer can be 'Equally important', or 'Moderately important' etc. The verbal responses are then quantified and translated according to the nine-point scale proposed by (Saaty, 1977). For instance, if all the major criteria with difference in importance are inputted into Expert Choice, their priorities from each set of judgments are found and recorded such as in Figure 3.

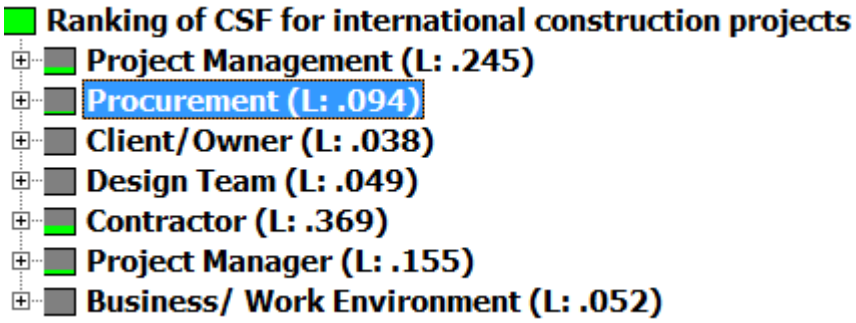

Figure 3. Evaluation of the local priorities of CSFs

Step 3 : Checking consistency

To validate the consistency of the judgments, Saaty proposes the consistency index (C.I.) and consistency ratio (C.R.). Random index (R.I) shows the average consistency index over numerous random entries of the same order reciprocal matrices. The value of R.I depends on Saaty's scale. If C.R. < 0.1, the approximation is accepted; otherwise new judgments are solicited. For more information on consistency ratios, readers are referred to (Saaty, 1980) An example of a pair-wise comparison judgment under the criteria Contractor is shown in Figure 4.

	Contractor'	Site manag	Extent of	Contract	Speed o
Contractor's experience		5.0	6.0	3.0	5.0
Site management and supervision			3.0	2.0	2.0
Extent of sub-contracting				4.0	3.0
Contractor's cash flow					3.0
Speed of information flow	Incon: 0.04				

Figure 4. Example of pairwise comparison and consistency check

Step 4: Final rankings

After calculating all the local weights for all levels of the hierarchy and checking the consistency we can then proceed to rank the critical success factors according to their priorities. When we synthesize all elements using Expert Choice, we obtain the results shown in Figure 5.

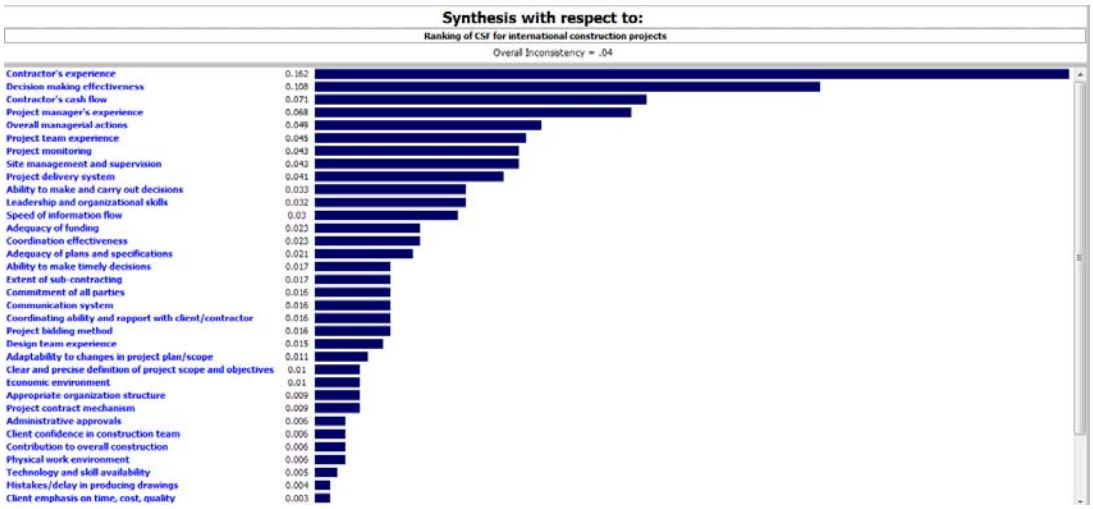

Figure 5. Synthesis of the CSFs and prioritisation

After analyzing all the 40 CSFs, the top 10 CSFs (with respect to their weights), ranked in descending order of criticality are shown in Table 1 and the main categories they fall under.

Table 1. Ranking of CSFs

Critical Success Factors	Category	Weights	Rank
Contractor's experience	Contractor	0.162	1
Decision making effectiveness	Project Management	0.108	2
Contractor's cash flow	Contractor	0.071	3
Project manager's experience	Project Manager	0.068	4
Overall managerial actions	Project Management	0.049	5
Project team experience	Project Management	0.045	6
Project team monitoring	Project Management	0.043	7
Site management and supervision	Contractor	0.043	7
Project delivery system	Procurement	0.041	9
Ability to make and carry out decisions	Project Manager	0.033	10

Conclusion and limitations

In this paper, we proposed the use of an AHP model to rank different critical success factors of Malaysian contractors in international projects. The results are purely based on the expert's assignation of the absolute priorities or weights of each criterion. By using this technique, the level of each attribute is compared to the others using pair-wise comparison method. According to experts (Zahedi, 1986), the fact of seeing attributes relative to others seems to be an easier way to calibrate their importance. Furthermore, by using AHP some inconsistencies may arise, thus giving place for the reconsideration of judgments and unclear thinking regarding the assessments of the criteria. Considering all the main factors, evidences showed that project management related factor is more important than the other main factors in terms of ranking although the contractor related main factor was given a higher weightage. However, contractor's experience under the contractor related main factor is the most critical among all the sub-factors. Since this research is conducted on Malaysian international contractors, findings should be interpreted in context of the Malaysian construction industry. Further, this study was limited to capturing the perception of construction professionals about critical success factors and did not examine whether the perceived factors would deliver a successful project if implemented in overseas construction projects. However, it can be a future research question linking perceived critical success factors in the beginning and actual success factors after the project completion, i.e. the key performance indicators (KPIs). Further study can be done to identify the KPIs so that causal relationships between CSFs and KPIs can be identified. Once the causal relationships are identified it can help in identifying development needs, strategizing the entry plan and most importantly be able to forecast the success level of a construction project before it commences.

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