



# Construction professionals' perception of critical success factors for large-scale construction projects

Large-scale  
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## Abstract

**Purpose** – Large-scale construction projects pose several challenges for successful completion. There seems to be no general agreement among researchers on what are the critical success factors (CSFs) on construction projects. Success factors vary across various projects, let alone countries. This paper attempts to elicit the perception of construction professionals on CSFs appertaining to large-scale construction projects in Thailand.

**Design/methodology/approach** – Questionnaire surveys and interviews were conducted with project managers, deputy project managers, and line managers to gather their perception on CSFs.

**Findings** – Results of 76 questionnaire surveys and 35 interviews revealed that factors related to project planning and control, project personnel, and involvement of client were perceived to be critical for the success of large-scale construction projects in Thailand. Participants also showed their high concern for sufficient resources, adequate communication, mutual understanding of stakeholders on project goals, and award of bids to the “right” designers and contractors.

**Research limitations/implications** – The study was conducted on a single large-scale construction project in Thailand, and hence, findings should be interpreted in context of Thai construction industry. The study also did not consider any specific procurement methods under which the project was being developed. Participants were asked about their general perception about CSFs on large-scale construction projects.

**Practical implications** – Results from this study can be used as guidelines to ascertain CSFs on other large-scale projects in Thailand. Project managers can also use this study to evaluate their current project and compare the perceived and real success factors for knowledge management exercises.

**Originality/value** – The paper captures the perception of construction professionals about CSFs in large-scale projects in Thailand. It also presents a model for conceptual illustration of CSFs by differentiating the process domain from performance domain.

**Keywords** Critical success factors, Thailand, Construction industry

**Paper type** Research paper



## Introduction

Search for project success factors is not new in management studies. Since 1960, various studies have been conducted to explore the factors that are really important to

be considered for achieving the success on projects (Cooke-Davies, 2002; Chan *et al.*, 2001). In their review, Belassi and Tukel (1996) note that the success and failure factors were first introduced by Rubin and Seeling (1967) in context of project management. However, the terminology of critical success factors (CSFs) for project management was first used by Rockart (1982 cited in Savindo *et al.*, 1992). Until today, numerous studies related to CSFs have been conducted in various sectors such as information technology (IT), industrial systems, construction, process engineering, business development, and operations management.

Researchers have frequently emphasized on the need for identifying a set of common success factors that can be used by construction professionals and project managers to measure the success on their projects. The current authors, however, are not convinced with this notion, particularly for construction project management. Even among several research studies, there seems to be little or no agreement on the list of success factors due to unique internal features and different boundary conditions of every construction project (Nguyen *et al.*, 2004). As claimed by Liu (1999), every project has a specific set of success factors which may not be transferable to another project. Although some characteristics are common in projects – for example, limited budget, schedule, quality standards and a series of complex and interrelated activities (Belout and Gauvreau, 2004), most vary from project to project. Composition of project team; constraints of resources; availability of local technical and managerial expertise; competence of contractors, subcontractors, and suppliers; physical attributes of project; its ground and environmental conditions; and finally geographic location are some of the factors that are mostly different for every construction project.

Disagreement on project success factors is also partly due to different perceptions about project success – measured against the overall objectives of the project and project management success and project management success – measured against the widespread and traditional measures of performance against cost, time and quality (Cooke-Davies, 2002) as well as how and when the success is measured. Moreover, there are diverse objectives of stakeholders that make it difficult even to agree upon a single comprehensive list of success factors (Phua, 2004). This viewpoint is also confirmed by Lim and Mohamed (1999) who argue that there are two possible viewpoints of project success: macro and micro. The macro viewpoint takes care of the question, “Is the original project concept achieved?” The users and stakeholders are usually the ones looking at project success from the macro viewpoint. The micro viewpoint deals with the project success in smaller component levels. Lim and Mohamed (1999) explain that micro viewpoint usually concerns the project construction phase and related construction parties involved in the project. During the construction phase, main project management goals such as time, cost, quality, safety are concerns of the contractual parties. At micro-level, every individual party perceives the project success from their own viewpoint. For example, the developer and contractor may look at project success from viewpoint depending upon what they achieved. Therefore, it is likely that various stakeholders perceive the project success and hence success factors differently. And it appears fairly complex to develop an inclusive list of success factors which take into account the nature of construction and participant organizations which are variable from project to project. Last but not the least, every project has different objectives which require sets of success factors (Chua *et al.*, 1999; Liu, 1999).

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### Research purpose

Toor and Ogunlana (2006) observe that most studies on CSFs for construction projects are context-specific. Therefore, the specific implications of studies on success factors are limited to the countries and cultures where these studies have been conducted. Toor and Ogunlana (2008) suggest that more studies should be conducted in other countries to account for the nature and structure of the local construction industry, scale of construction projects, procurement strategies, maturity of the concerned organizations, and local cultural values and norms. Also, ever changing socio-economic and cultural changes have been growingly perplexing and the globalization of the construction industry has posed numerous challenges to the concerned players at all levels (Lewis, 2006; Ofori, 2007; Raftery *et al.*, 1998). Particularly in the developing world, where construction activity is heavily influenced by the foreign players, cross-cultural interactions play a key role in negotiations, decision making, problem solving, and all sorts of other business dealings. Therefore, research examining the CSFs on large-scale construction projects will not only facilitate to prepare customized CSF lists for other similar projects but also help to comprehend the factors that contribute to project success under different contexts. Such studies will also help to reduce the effort of preparing modified CSF lists as well as understanding specific features of particular types of projects in construction industries of different countries.

This paper targets to capture the perception of construction stakeholders – client/developers, consultants, designers, and contractors – about CSFs on large-scale construction projects in Thailand. Under the above objective, the study also targets to examine whether the perception of all construction stakeholders at micro level (client, designers, consultants, and contractors) is same about CSFs in large-scale construction projects.

### Summary of previous work

Rockart (1982) was the first to use the term “critical success factors.” The term “critical success factor” or CSF implies certain element which significantly contributes to, and is vital for, the success of a project. Therefore, to be able to achieve success on project, one must start by determining the factors that affect project success and cause project failure. The concept of CSFs has been researched extensively in several fields including construction, medicine, IT, and production industry. Particularly, in the domain of construction and project management, last two-and-half decades have witnessed a drastic increase in CSF research (Toor and Ogunlana, 2005). Studies have been conducted to explore CSFs in general construction projects (Ashley *et al.*, 1987; Pinto and Slevin, 1988; Savindo *et al.*, 1992; Chua *et al.*, 1999; Egbu, 1999; Phua and Rowlinson, 2004; Fortune and White, 2006), design-build projects (Chan *et al.*, 2001; Songer and Molenaar, 1997; Ng and Mo, 1997), public-private-partnerships or BOT (Zhang, 2005; Li *et al.*, 2005; Tiong, 1996; Jefferies *et al.*, 2002), international and multi-firm projects (Mohsini and Davidson, 1992; Phua, 2004; Gale and Luo, 2004), large-scale construction projects (Nguyen *et al.*, 2004), and various other project management topics (Hatush and Skitmore, 1997; Cooke-Davies, 2002; Nicolini, 2002; Yu *et al.*, 2005; Fortune and White, 2006).

Low and Chuan (2006) note that project success is a basic concept in project management. However, they argue that the traditional definition of project success – which emphasizes time, cost, and quality – is not so adequate and comprehensive.

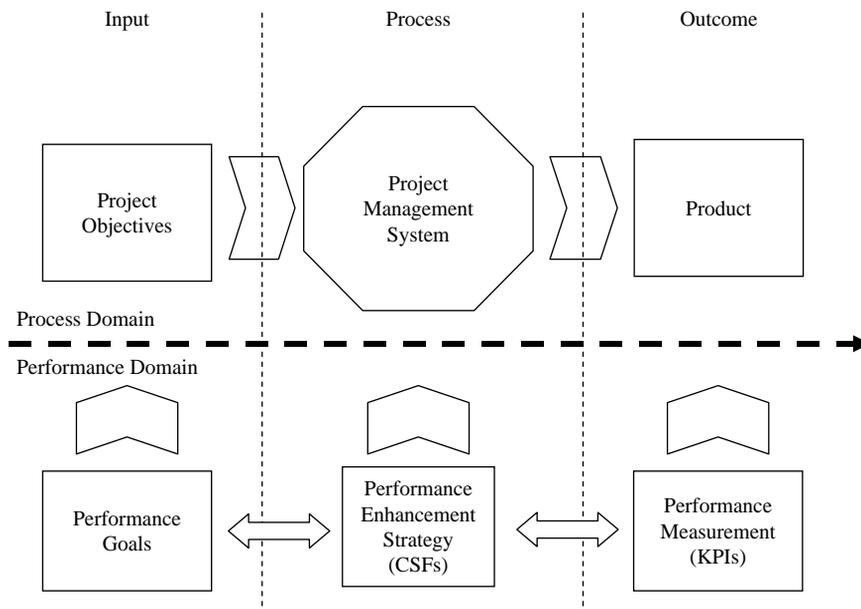
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Such approach of defining the success can lead to a very objective measurement of project success which, in view of Low and Chuan (2006), appears to be not only difficult but also ambiguous. This is because project success does not commensurate with the product success. Also, success can mean different to different project stakeholders (Toor and Ogunlana, 2005) and individuals (Freeman and Beale, 1992). What most people perceive as project success is, in reality, the product success. Phua (2004) is of the view that multi-firm project success can be defined and measured, at least at the operational level, as the extent to which projects meet a combination of budget, timetable and technical specifications. Savindo *et al.* (1992) relates the success of a project to the expectation of its participants which may be owner, planner, engineer, contractor or operator. Success of a construction project can be considered as achievement of specific objectives through project management system that involves a series of activities and tasks which consume resources. To be recognized as a successful project, it must be completed according to certain specifications, having definite start and end dates, within specified budget, and in accordance with stakeholders' satisfaction (Munns and Bjeirmi, 1996; Nguyen *et al.*, 2004).

To accomplish these major objectives through a project management system, identification of success factors play a key role, particularly for strategizing the project performance management during both design and execution phases. Various researchers have introduced exhaustive lists of such factors which vary from less than 10 to over 60 factors. Most success factors mentioned in previous studies belong to some principal categories such as: project-related factors, human-related factors, project procedures, external environment, project management system, and structural factors. Although different researches emphasize different set success factors, all of them commonly agree on importance of human factors (Low and Chuan, 2006). Several research works have also attempted to factorize the larger taxonomies of success factors into fewer grouping (Ashley *et al.*, 1987; Chua *et al.*, 1999; Chan *et al.*, 2001; Nguyen *et al.*, 2004; Li *et al.*, 2005; Fortune and White, 2006). Literature on success factors also reveals that studies on the subject have been conducted in countries including the UK, the USA, Hong Kong, China, Singapore, Vietnam, and Australia. However, no such study has been conducted in Thailand, particularly in context of large-scale construction projects. This research is therefore dedicated to explore CSFs in large-scale construction projects in Thailand.

### **Conceptual and practical illustration of CSFs**

To understand the role of CSFs, the authors present a conceptual illustration is shown in Figure 1 (Toor and Ogunlana, 2005, 2008). It shows that project management can be categorized into three general phases – input, process, and outcome – and two major domains – process and performance domain. Process domain accounts for setting up the project objectives during the input stage. During the process phase, process domain takes account for devising an adequate project management system to achieve these project management objectives in form of the product or constructed facility. Process domain of a project ends with delivery of product which is its eventual outcome. However, performance domain is focused on setting up the performance goals during the input stage. During the process phase, performance domain involves the establishment of performance enhancement strategy in form of CSFs. Performance enhancement strategy (or CSFs) – certain element which significantly contributes to,



**Figure 1.**  
Input, process, and  
outcome of project  
management

and is vital for, the success of a project – can be measured through key performance indicators – criteria on the basis of which one can measure the success of a project – during the outcome phase. Conceptual model in Figure 1 shows that process and performance domains are different in nature but interrelated in many ways, as parts of the whole project management. Process domain and performance domain are also similar to Baccarini's (1996) concept of product success and project management success, respectively. Although each and every feature of the model in Figure 1 carries its own value for project success, performance enhancement strategy (or appraisal of CSFs) is a vital aspect and has profound implications on performance outcomes.

From practical point-of-view, identification of CSFs has many promising applications (Nguyen *et al.*, 2004). First of all, CSFs can be helpful to analyze the potential reasons of project success or failure (Low and Chuan, 2006). Second, appraisal of CSFs can also help in selection of project team members, identification of their development needs, and forecast of performance level of a project before it commences (Chan *et al.*, 2001). Third, CSFs also provide an underlying decision framework (Songer and Molenaar, 1997) and help the firms to decide their strategic standing on the project. Phua (2004, p. 458) echoes the similar notion and claims that firms that understand, manage, and exploit the underlying differences in perception of success factors stand well to:

[...] benefit from being able to devise better strategies that aim at improving resource use, project delivery processes and productivity which in turn enables them to compete more effectively in the market.

Furthermore, construction projects invariably involve a variety of human, budgetary, and technical variables. Identification of CSFs enables the effective allocation of limited resources such as time, manpower and budget for the project (Chua *et al.*, 1999).

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Therefore, at the very outset of the project, it is important for project management team to comprehend the critical factors which are likely to enhance the probability of success. Once project team members are well aware of project success factors, they can easily identify and prioritize critical issues associated with implementing the project plan (Boynton and Zmud, 1984; Clarke, 1999).

Clarke (1999) also asserts that Pareto's law can be successfully implemented after identification of success factors. Organizations can effectively divert their resources in those directions where they know maximum success lies. Though, only a holistic approach towards project management can result in desired results, focusing on "important few" will deliver the greatest benefit (Clarke, 1999). Therefore, it is clear that appraisal of CSFs has far-reaching implications and it can really help the project leaders to accomplish the project objectives and scope.

### **Research methodology**

In order to elicit the perception of professionals about CSFs for large-scale construction projects, a mix of both quantitative and qualitative approaches was employed. To develop a comprehensive questionnaire, a thorough literature review was carried out that resulted in identification of 45 CSFs for large-scale construction projects. This provided the basis for the formulation of a preliminary questionnaire. To refine the items in the preliminary questionnaire, a pilot survey was carried out with three academic experts and three industry practitioners followed by personal interviews with the same individuals. This resulted in few modifications in the initial list of CSFs. Some items were deleted due to their repetition in form of other items or their likely irrelevance to the Thai construction industry. Few items were combined for better understanding of the participants. Some items were reworded to adapt to the terminology used in the local construction industry. And some additional items were included as per recommendations received during the pilot phase. As a result of this exercise, a list of 39 success factors was finalized to be included in the final version of the questionnaire. It can be seen from the Table I that these success factors have been widely mentioned in the lists of success factors in the previous works on the subject and therefore carried a robust literature backing. At a later stage during analysis, Cronbach's  $\alpha$  was calculated in order to check the internal reliability of the CSFs included in the questionnaire. This resulted in a high value of 0.931 which again confirmed the internal reliability of the items included in the questionnaire.

A total of 80 questionnaires were delivered to the participants in person, together with a covering letter explaining the purpose of the study and assuring them of anonymity. Participants were project managers, deputy project managers, and line managers involved in various construction projects under the larger development of the Suvarnabhumi International Airport of Thailand. It is important to note that the Suvarnabhumi International Airport is the largest construction project in the history of the Thailand construction industry and has been declared as the "national priority" by the Thai Government. Selecting this project as a case ensured that all participants had hands-on working experience of large-scale construction projects. To help the data collection, the client organization also sent out supporting e-mail request to all available consultants, designers, and contractors and encouraged them to participate in the study, interviews and questionnaire surveys. The support from the client and follow up e-mail reminders resulted in a high-response rate. Out of total

No.	Description of success factor	Relevant literature
1	Competent project manager	Kerzner (1987), Pinto and Slevin (1988), Belassi and Tukel (1996), Mumns and Bjeirmi (1996), Chua <i>et al.</i> (1999), Egbu (1999), Nguyen <i>et al.</i> (2004), Nicolini (2002) and Fortune and White (2006)
2	Competent team members	Pinto and Slevin (1988), Chua <i>et al.</i> (1999), Nicolini (2002), Nguyen <i>et al.</i> (2004), Belout and Gauvreau (2004) and Fortune and White (2006)
3	Building a balanced and winning team	Nguyen <i>et al.</i> (2004)
4	Regular client consultation	Pinto and Slevin (1988)
5	Responsiveness of client	Songer and Molenaar (1997), Phua (2004), Yu <i>et al.</i> (2005) and Fortune and White (2006)
6	Knowing what client really wants	Yu <i>et al.</i> (2005) and Fortune and White (2006)
7	Clear prioritization of project goals by the client	Chan <i>et al.</i> (2001), Nguyen <i>et al.</i> (2004) and Yu <i>et al.</i> (2005)
8	Client acceptance of plans	Pinto and Slevin (1988) and Belout and Gauvreau (2004)
9	Awarding bids to the right designers/contractors	Songer and Molenaar (1997), Nguyen <i>et al.</i> (2004), Phua (2004) and Gale and Luo (2004)
10	High-quality workmanship	Fortune and White (2006)
11	Top management sponsorship	Kerzner (1987), Pinto and Slevin (1988), Chua <i>et al.</i> (1999), Nicolini (2002), Belout and Gauvreau (2004), Nguyen <i>et al.</i> (2004), Yu <i>et al.</i> (2005) and Fortune and White (2006)
12	Proven methodology (that includes a vision process) of project management and project procurement	Hughes (1986), Mumns and Bjeirmi (1996), Phua (2004) and Fortune and White (2006)
13	Effective project planning and control	Ashley <i>et al.</i> (1987), Kerzner (1987), Belassi and Tukel (1996), Mumns and Bjeirmi (1996), Turner (1999), Egbu (1999), Nguyen <i>et al.</i> (2004), Chan <i>et al.</i> (2001), Nicolini (2002), Cooke-Davies (2002), Belout and Gauvreau (2004) and Fortune and White (2006)
14	Effective change management	Chan <i>et al.</i> (2001), Cooke-Davies (2002), Phua (2004), Arain and Low (2005), Fortune and White (2006) and Yu <i>et al.</i> (2005)
15	Sufficient resources	Turner (1999), Belassi and Tukel (1996), Songer and Molenaar (1997), Chua <i>et al.</i> (1999), Nguyen <i>et al.</i> (2004), Phua (2004), Yu <i>et al.</i> (2005) and Fortune and White (2006)
16	Clearly written lines of responsibility	Chua <i>et al.</i> (1999) and Nicolini (2002)
17	Clear and detailed written contract	Chua <i>et al.</i> (1999), Nguyen <i>et al.</i> (2004) and Phua (2004)
18	Proper dispute resolution clauses incorporated in the contract	Chua <i>et al.</i> (1999)
19	Developing positive friendly relationships with project stakeholders	Ng and Mo (1997), Chua <i>et al.</i> (1999), Nguyen <i>et al.</i> (2004), Phua (2004) and Yu <i>et al.</i> (2005)

(continued)

**Table I.**  
Final list of success  
factors for questionnaire  
survey

No.	Description of success factor	Relevant literature
20	Clearly defined goals and priorities of all stakeholders	Hughes (1986), Pinto and Slevin (1988), Munns and Bjeirmi (1996), Songer and Molenaar (1997), Jang and Lee (1998), Clarke (1999), Chua <i>et al.</i> (1999), Chan <i>et al.</i> (2001), Nicolini (2002), Nguyen <i>et al.</i> (2004), Gale and Luo (2004), Yu <i>et al.</i> (2005) and Fortune and White (2006)
21	Strategic alignment of project goals with stakeholders' interests	Songer and Molenaar (1997), Nguyen <i>et al.</i> (2004) and Yu <i>et al.</i> (2005)
22	Adequate communication among related parties	Hughes (1986), Ashley <i>et al.</i> (1987), Pinto and Slevin (1988), Ng and Mo (1987), Egbu (1999), Turner (1999), Chua <i>et al.</i> (1999), Chan <i>et al.</i> (2001), Nicolini (2002), Cooke-Davies (2002), Nguyen <i>et al.</i> (2004), Phua (2004), Yu <i>et al.</i> (2005), Belout and Gauvreau (2004) and Fortune and White (2006)
23	Mutual trust among project stakeholders	Chua <i>et al.</i> (1999), Chan <i>et al.</i> (2001), Nguyen <i>et al.</i> (2004), Phua (2004) and Yu <i>et al.</i> (2005)
24	Frequent meetings among various stakeholder to evaluate overall performance	Nicolini (2002), Nguyen <i>et al.</i> (2004) and Yu <i>et al.</i> (2005)
25	Absence of bureaucracy from the work place	Nguyen <i>et al.</i> (2004) and Phua (2004);
26	Learning from previous experiences	Nguyen <i>et al.</i> (2004) and Yu <i>et al.</i> (2005)
27	Reliable estimates by quantity surveyors	Nguyen <i>et al.</i> (2004)
28	Positive organizational culture for effective project management	Kerzner (1987)
29	Requiring the use of facts and data to support actions at all levels of decision making	Nguyen <i>et al.</i> (2004), Yu <i>et al.</i> (2005), Fortune and White (2006), Egbu (1999) and Gale and Luo (2004)
30	Feedback capabilities in the system	Nicolini (2002) and Fortune and White (2006)
31	Benchmarking firm's performance against successful projects	Yu <i>et al.</i> (2005)
32	Conducting regular reviews to assure and verify progress on project	Nicolini (2002) and Nguyen <i>et al.</i> (2004)
33	Effective project control mechanics	Ashley <i>et al.</i> (1987), Pinto and Slevin (1988), Cooke-Davies (2002), Nguyen <i>et al.</i> (2004), Phua (2004), Belout and Gauvreau (2004) and Gale and Luo (2004)
34	Fast trouble-shooting capabilities in the system	Pinto and Slevin (1988) and Belout and Gauvreau (2004)
35	Creating accountabilities, expectations, roles, and responsibilities for the organization	Nicolini (2002) and Yu <i>et al.</i> (2005)
36	Adequate work breakdown structure (WBS) linked with organizational breakdown structure (OBS)	Nguyen <i>et al.</i> (2004) and Yu <i>et al.</i> (2005)
37	Clearly designed and coordinated technical tasks	Ashley <i>et al.</i> (1987), Pinto and Slevin (1988), Nicolini (2002) and Belout and Gauvreau (2004)
38	Standard software infrastructure and adequate use of IT	Sommerville and Craig (2006, 2004)
39	Using up to date technology and automation for construction work	Songer and Molenaar (1997), Chan <i>et al.</i> (2001), Nguyen <i>et al.</i> (2004), Phua (2004) and Fortune and White (2006)

80 questionnaires, 76 were collected back that yielded a response rate of over 95 percent. Participants were asked to rate each success factor based on their frequency of occurrence according to their professional judgment on a given five-point Likert-type rating scale from 1 to 5 (where 1 – not important at all and 5 – extremely important).

In addition to the questionnaire surveys, 35 face-to-face semi-structured interviews were also conducted with the professionals who had responded to the questionnaires. This was done to gather the personal accounts, observations, and experiences of the professionals regarding success factors in the large-scale construction projects. These rich personal accounts of the professionals were useful to explain the questionnaire findings in the analysis stage.

### Background of participants

Tables II and III provide background of research participants. Table II shows that almost half of the participants were project managers, deputy project managers, and construction managers. Others were holding the designation of line managers (quality control manager, contracts manager, design manager, designer coordinator, site manager, etc.). All the participants were professionally positioned at middle or higher management level which implies that a certain level of accuracy and credibility in the data collected were achieved. It can be seen from Table III that majority of the participants had considerable experience both in the field of project management as well as project manager. Further, more than 80 percent of the participants had educational background of civil engineering. Others held professional degrees in mechanical, electrical engineering, commerce, computer sciences, and social sciences. All participants had experience of working in large-scale construction projects and most were working in joint ventures and consortiums in addition to their

Group	Project manager	Deputy project manager	Project engineer	Line manager	Total responses
CR	1	1	2	3	7
PMC	1	1	–	8	10
CSC	7	7	4	20	38
DC	2	–	–	3	5
CC	3	2	1	10	16
Total	14	11	7	44	76

**Notes:** CR – client representative; PMC – project management consultants; CSC – construction supervision consultants; DC – design consultants; CC – construction contractors

**Table II.**  
Positions held  
by participants

Experience (years)	Experience in project management	Experience as project manager
≤5	13	27
6-10	18	21
11-15	13	11
16-20	18	8
21-25	8	7
26-30	4	1
>30	2	1

**Table III.**  
Experience of participants

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parent organizations. Based on their nature of organization, participants were divided into following five groups:

- (1) Client/developer representatives.
- (2) Project management consultants.
- (3) Construction supervision consultants.
- (4) Design consultants.
- (5) Construction contractors.

### **Hypothesis testing**

In order to test whether different groups of participants differed in their perception about CSFs on large-scale construction projects, analysis of variance (ANOVA) was performed. Results of ANOVA are shown in Table IV which show that different groups of participants differed on only three success factors ( $p < 0.01$ ) out of total 39. This illustrated that various participant groups had the same perception about CSFs for large-scale construction projects.

### **Overall ranking of success factors**

Table IV shows overall ratings of CSFs with respect to sample as well as group-wise. Results in Table IV illustrate that there is no significant difference in perception of CSFs among various participant groups. Therefore, it is plausible to group all participants together for ranking of success factors on basis of overall sample. Mean scores and respective ranks of success factors for overall sample as well as different participant groups are shown in Table IV. This ranking approach has been adopted by a several researchers (Low and Chuan, 2006; Gale and Luo, 2004; Nguyen *et al.*, 2004; Li *et al.*, 2005). It can be seen that various participant groups have given nearly same ratings to the success factors. It is also notable that all participant groups have given significant importance to effective project planning and control, availability of sufficient resources, clarity and details of the written contract, and competence of the project manager. Results in Table IV are also in-line with other research investigations conducted in other parts of the world. Comparison of Tables I and IV show that top rated success factors carry strong support from the studies published in the past. Effective project planning and control has been emphasized in several research investigations (Kerzner, 1987; Pinto and Slevin, 1988; Chua *et al.*, 1999; Phua and Rowlinson, 2004). Sufficiency of resources, clarity of contract, and prioritization of goals has also been underscored by numerous research investigations (Ashley *et al.*, 1987; Pinto and Slevin, 1988; Savindo *et al.*, 1992; Chua *et al.*, 1999; Egbu, 1999; Phua and Rowlinson, 2004; Chan *et al.*, 2001; Songer and Molenaar, 1997; Ng and Mo, 1997; Jefferies *et al.*, 2002).

Ratings of few success factors in Table IV can be discussed more in detail. Very low rating of “effective project planning and control” and “clearly defined goals and priorities of all stakeholders” by the clients’ group is not very clear although other participant groups have given fairly high ratings to these factors. It is also notable that “competent project manager” has been rated even lower although this factor has been perceived reasonably important by the other groups. “Knowing what client really wants” is also rated low by the clients which was expected otherwise. Another surprising point is rating of “strategic alignment of project goals with

No.	Critical success factors	Overall (76%)		CR (7)		PMC (10)		CSC (38)		DC (5)		CC (16)		ANOVA	
		M <sup>b</sup>	R <sup>b</sup>	M	R	M	R	M	R	M	R	M	R	F-value	Sig.
1	Effective project planning and control	4.42	1	3.71	20	4.70	1	4.45	3	4.40	3	4.50	3	6.76	0.01
2	Sufficient resources	4.37	2	4.14	6	4.30	8	4.34	8	4.40	6	4.56	2	0.03	0.87
3	Clear and detailed written contract	4.34	3	4.29	3	3.90	25	4.45	4	4.60	2	4.31	10	0.24	0.63
4	Clearly defined goals and priorities of all stakeholders	4.33	4	3.29	33	4.60	2	4.37	7	4.40	4	4.50	4	9.66	0.00*
5	Competent project manager	4.33	5	3.29	34	4.40	3	4.45	1	4.40	5	4.44	7	10.59	0.00*
6	Adequate communication among related parties	4.32	6	3.86	12	4.30	9	4.45	2	4.20	11	4.25	11	2.75	0.10
7	Competent team members	4.30	7	4.14	5	4.30	7	4.32	9	3.80	23	4.50	5	0.12	0.73
8	Knowing what client really wants	4.29	8	3.43	29	4.40	5	4.39	5	4.60	1	4.25	12	5.08	0.03
9	Responsiveness of client	4.25	9	4.43	2	4.00	14	4.37	6	4.20	12	4.06	20	0.84	0.36
10	Awarding bids to the right designers/contractors	4.24	10	3.86	14	4.40	6	4.16	15	4.40	8	4.44	8	0.26	0.61
11	High-quality workmanship	4.17	11	4.00	11	4.10	12	4.21	10	4.00	20	4.25	14	0.84	0.36
12	Regular client consultation	4.14	12	4.57	1	4.00	13	4.21	12	4.20	10	3.88	28	3.38	0.07
13	Top management sponsorship	4.13	13	3.71	16	3.90	22	4.21	11	3.60	26	4.44	6	1.17	0.28
14	Learning from previous experiences	4.13	14	4.29	4	4.00	21	4.13	17	4.00	21	4.19	16	0.16	0.69
15	Building a balanced and winning team	4.07	15	3.86	13	3.80	29	4.05	21	4.40	7	4.25	13	0.08	0.78
16	Client acceptance of plans	4.05	16	3.43	28	4.10	11	4.18	13	4.00	16	4.00	23	3.10	0.08
17	Reliable estimates by quantity surveyors	4.00	17	3.57	24	3.90	24	4.03	22	4.20	13	4.13	17	2.28	0.14
18	Positive organizational culture for effective project management	4.00	18	4.00	9	4.20	10	4.11	18	3.40	33	3.81	33	1.72	0.19
19	Clear prioritization of project goals by the client	4.00	19	3.29	36	4.00	20	3.95	29	4.20	15	4.38	9	0.28	0.60
20	Requiring the use of facts and data to support actions at all levels of decision making	4.00	20	3.43	32	3.70	38	4.18	14	4.00	18	4.00	24	4.45	0.05
21	Creating accountabilities, expectations, roles, and responsibilities for the organization	3.99	21	3.71	19	4.00	19	3.97	28	3.80	25	4.19	15	0.81	0.37
22	Feedback capabilities in the system	3.97	22	4.00	8	3.70	35	4.13	16	3.60	28	3.88	29	0.38	0.54
23	Clearly written lines of responsibility	3.96	23	3.29	35	4.00	16	4.03	23	4.00	17	4.06	22	6.67	0.01
24	Mutual trust among project stakeholders	3.96	24	4.00	10	4.00	18	3.97	27	3.80	24	3.94	25	0.34	0.56
25	Strategic alignment of project goals with stakeholders' interests	3.95	25	3.71	17	3.80	27	3.89	32	3.00	38	4.56	1	0.05	0.83

(continued)

Table IV. Overall sample and group-wise ratings of CSFs

No.	Critical success factors	Overall (76 <sup>a</sup> )		CR (7)		PMC (10)		CSC (38)		DC (5)		CC (16)		ANOVA	
		M <sup>b</sup>	R <sup>b</sup>	M	R	M	R	M	R	M	R	M	R	F-value	Sig.
26	Proven methodology (that includes a vision process) of project management and project procurement	3.93	26	4.00	7	3.90	23	3.89	30	3.80	22	4.06	19	0.97	0.33
27	Conducting regular reviews to assure and verify progress on project	3.91	27	3.43	30	3.80	31	4.00	24	4.20	14	3.88	30	0.01	0.93
28	Proper dispute resolution clauses incorporated in the contract	3.91	28	3.71	21	3.70	39	4.11	19	4.00	19	3.63	36	1.16	0.28
29	Frequent meetings among various stakeholder to evaluate overall performance	3.89	29	3.14	38	3.80	33	3.89	31	4.40	9	4.13	18	8.87	0.00*
30	Fast trouble-shooting capabilities in the system	3.89	30	3.57	23	3.80	28	3.97	26	3.40	31	4.06	21	2.29	0.14
31	Adequate WBS linked with OBS	3.89	31	3.43	31	4.40	4	3.97	25	3.20	35	3.81	32	0.78	0.38
32	Clearly designed and coordinated technical tasks	3.88	32	3.00	39	4.00	15	4.08	20	3.60	29	3.81	31	5.06	0.03
33	Absence of bureaucracy from the work place	3.80	33	3.86	15	3.90	26	3.79	36	3.20	37	3.94	26	0.12	0.73
34	Effective change management	3.76	34	3.57	27	3.70	34	3.79	34	3.60	27	3.88	27	0.20	0.66
35	Effective project control mechanics	3.70	35	3.57	22	3.70	36	3.82	33	3.20	34	3.63	35	0.10	0.76
36	Developing positive friendly relationships with project stakeholders	3.70	36	3.57	25	4.00	17	3.71	37	3.60	30	3.56	37	0.01	0.91
37	Standard software infrastructure and adequate use of IT	3.64	37	3.71	18	3.70	37	3.79	35	3.40	32	3.31	39	0.38	0.54
38	Benchmarking firm's performance against successful projects	3.61	38	3.14	37	3.80	30	3.63	38	3.00	39	3.81	34	0.88	0.35
39	Using up to date technology and automation for construction work	3.57	39	3.57	26	3.80	32	3.61	39	3.20	36	3.44	38	0.00	0.96

**Notes:** \*Significant difference at 90 percent confidence level. <sup>a</sup>The number of responses under different groups of participants. <sup>b</sup>M and R denote mean score and rank, respectively

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stakeholders' interests" by the contractor who have rated this factor to the top. On the other hand, all other participant groups have rated this factor as relatively less important. "Regular client consultation" has also been rated fairly low by all participant groups except the clients who have rated this factor on the top of their list. From the rating of success factors, it is understandable that this ranking is very specific in the context of large-scale construction projects in Thailand and therefore must be interpreted carefully. Ranking of some important factors does not really mean that they are not important or they should not be paid deserved attention. Low ranking of such factors is rather relative to other factors which have been perceived more important in this context.

### **Discussion of results**

Results of analysis in this study are in line with several other studies conducted in the other parts of the world. Rating of success factors in Table IV reveals high-scoring factors are mostly related to three major aspects that are: project planning and control; personnel; and involvement of client. These themes were also revealed during the interview sessions in which interviewees mostly emphasized on the need of effective project planning and control, competent personnel, and continuous involvement of client.

#### *Project planning and control*

Numerous research investigations have put the accent on importance of project planning and control (Kerzner, 1987; Pinto and Slevin, 1988; Phua and Rowlinson, 2004). Since "project planning and control" covers several other aspects (such as goal setting, legal and contractual risk management, procurement management and change management), its importance is manifold. Large-scale construction project needs a very careful and thorough planning before the actual execution and then control while project is on its way. There are both social and economic expectations out of large-scale projects. Therefore, late completion can harm the expected outcomes, result in enormous loss of money and efforts and scratch the credibility of project itself (Arain and Low, 2005). Effective project planning and control is also pertinent to clearly defined goals for the successful completion of project. One construction manager also emphasized on the same and said:

Project planning and implementation of effective control mechanism is the backbone of any construction project. You can have plenty of resources but weak planning and loose control will lead to nothing. And this has to be done in the very initial stage of the project. If you continue to rely on emergent planning and contingency control, project is destined to produce less than expected results.

Inadequate planning means that the project can end up behind schedule and with unexpected delays (Clarke, 1999). Unless the project team knows where they wish to get to, it is difficult to attain the desired product. Therefore, setting very clear, realistic, identifiable, and goals by all project participants is vital (Lim and Mohamed, 1999). It allows the team members to know where they stand at the moment how far they stand from the goal, what they need to do to achieve success on time, and when they are going to get there. Once it has been done with appropriate project planning and control and goal setting, accomplishment of the project objectives is far easier.

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*Project personnel*

Competence of the personnel is another theme that emerged in the rating of success factors. Competent and experienced project team has been mentioned in several past studies as well (Belout and Gauvreau, 2004; Rogers, 1990; Sommerville and Dalziel, 1998). A team with expert, knowledgeable, experienced, and proficient team members is essential for the success accomplishment of project goals. Some researchers particularly emphasize the competencies of contractors and clients (Chan *et al.*, 2001; Ng and Mo, 1997); some assert on the competencies of all project participants (Pinto and Slevin, 1988; Martinez, 1994; Westerveld, 2003); and many more underline the competence of project manager (Nguyen *et al.*, 2004; Kerzner, 1987; Chua *et al.*, 1999; Egbu, 1999). A deputy project manager underscored the importance of project manager and said:

A Project Manager is like the conductor of the construction orchestra. In our profession, we cannot afford to have someone as project manager who does not know about the field. We come across many technical problems and issues that need expert skills to find a solution. Role of Project Manager is crucial in such circumstances. If he is not competent and does not know how to solve the problem, it is very difficult to move forward. This also causes excessive delays and incompetent project managers do not know how to make decisions, how to negotiate problems, and how to constructively resolve a dispute.

Studies have also shown that leadership capabilities of project manager can greatly influence the project outcomes (Odusami, 2002; Toor and Ogunlana, 2005; Toor and Ofori, 2006). One project manager reflected upon the importance of leadership qualities of the project manager for successful accomplishment of the project. He said:

Construction is not a usual business. I have to deal with a huge range of concerned parties, government agencies, and politicians. To do this all successfully, I have to demonstrate leadership. And it's not about my own leadership but it's also about how I share my leadership authority with other team members. I can only delegate the tasks and overlook the whole project. Major ground work is done by my team members. If I don't lead them and give them enough responsibility and authority, I cannot finish my job.

*Involvement of client*

It can be noticed from the ratings that five client-related factors have obtained scores among top twenty rated success factors. Moreover, several other factors such as "sufficient resources" and "awarding bids to right designers/contractors" etcetera are also indirectly related to role of client or developer in the project. Here, role of the client has two sides: how client understands his roles and participates in the project planning and execution; and how other stakeholders such as designers and contractors comprehend the needs of client for project. From first point of view, the client, who is owner of the project and knows exactly what the requirements of final product. He should be able to convey his requirements and expectations to other stakeholders in most effective manner. At the same time, the client should be responsive to the needs of concerned parties so that delays can be avoided (Pinto and Slevin, 1988).

Low and Chuan (2006) also argue that poor project performance may not necessarily be due to the incompetence of anyone else but the client itself. They assert that "clients' actions before, during and after the project can affect the performance of a project." Therefore, client should also be well aware of the prevailing situation of the project

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during different stages (Bresnen and Haslam, 1991). It should be noted that client responsiveness has many dimensions, for example: client should be clear about what they are being asked; client should be quick in their response; client need to be clear about the decisions made; client must be well aware of the ramifications of the decisions; client should ensure that the decisions are clearly communicated to the related parties; and finally client should adequately address the financial needs of other stakeholders. From another viewpoint, other parties should also regularly communicate with the client to avoid any ambiguities with his requirements and needs (Phua and Rowlinson, 2004). Construction projects involve numerous changes and alterations in design. Therefore, client's involvement is essential to avoid any possible litigation at a later stage. One project manager representing a contractor organization shared this perspective and said:

There are so many changes we deal with on daily basis. We have to ensure that the client is constantly involved in the whole process to avoid any complex situation at a later stage. Many changes are initiated by the client itself. However, we have to tell them the consequences and costs of such changes. The changes which are initiated by us have also to be communicated to the client so that they know why we want the modification in design. It's the client who must agree with all the changes otherwise there is a danger of a huge mess in when no body wants to bear the cost.

Where there are so many advantages of active client in the project, lack of client's involvement can be critically dangerous resulting in unexpected changes, delays, cost overruns, and conflicts on the projects (Millet, 1999; Toor and Ogunlana, 2006; Fortune and White, 2006). Briefly, for successful project outcomes, client must ensure to play an active role during all phases of project (Blyth and Worthington, 2001; Low and Chuan, 2006).

### **Conclusion and future directions**

Success of construction projects depends on several aspects which may include human-related factors, project-related factors, project management-related factors, and factors related to external environment. Depending on their needs, different participants in construction may have divergent interests in the project but they must have an agreement, in principle, about project objectives and critical factors that can help to achieve those objectives. Results in this study reveal that most of the high-rated CSFs are related to project planning and control, personnel, and involvement of client. This was not only observed from the results of questionnaire survey but also interviews conducted as a part of this study also highlighted the same issues. In terms of practical application, project leaders can use these findings to establish CSFs for their own construction projects in Thailand. Project leaders can also compare these success factors with real success factors in they have already accomplished in the past. This can prove to be a healthy knowledge management exercise and can be used as baseline for establishing and implementing performance enhancement strategy for Thai construction projects. Also, project managers can work out measures for improvement to raise the probability of success and reduce the chances of any setbacks in their own projects.

However, while interpreting the findings, one should bear in mind that data were collected from a single large-scale construction project in Thailand and therefore generalization of results may not be appropriate in the other contexts – such as other countries, different type of projects and procurement system. Different countries and

geographical locations have their own set of socio-economic and political factors, structure of the construction industry, local construction practices, and more importantly, the project characteristics which together influence the success of a given project. Therefore, it may not be appropriate to generalize the findings or replicate the similar set of CSFs in other geographical locations and on completely different types of projects. However, such findings can be used as guidelines to compliment best practices of construction project management in different countries. It should be noted that the current study did not consider any specific procurement methods to elicit CSFs. Participants were asked about their general perception about success factors on large-scale construction projects. However, further studies on the subject may consider more specific issues for Thailand construction industry, including: success factors for project involving other procurement systems such as design-build and public-private partnerships; success factors for different project sizes; and success factors for different project types, such as housing, infrastructure, etc.

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