Critical Success Factors for Contractors

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***Abstract* - The aim of this paper is to identify the Critical Success Factors (CSFs) as perceived among the contractors registered under the Development Unit at Universiti Teknologi MARA (UiTM) Shah Alam. To achieve the objectives, 68 related factors for successful construction of projects were classified into project characteristics, contractual arrangements, project participants and interactive process. A questionnaire survey was administered to 120 contractors and it was found that site limitation and location, project size, adequacy of funding, technical approval authorities, pioneering status, constructability, economic risks, political risks and impact on the public were critical towards the success of the projects. Additionally, the contractual arrangements, formal dispute resolution process, adequacy of plans and specifications, realistic obligations and clear objectives, motivation and incentives, risk identification and allocation were considered critical. Different sets of critical success factors were identified for the different objectives (time, quality and cost). By focusing on the CSFs identified in this research, project teams have a better chance of achieving excellent project performance and will be able to furnish clients and other project stakeholders with useful information to successfully implement projects.**

***Keywords* - Critical success factors, Contractors**

I. INTRODUCTION

The CSF approach has been used as a management measure since the 1970s [1] [2] and is currently a popular research approach across a wide range of disciplines including construction management [3] [4] [5] [6]. According to [7], main contractors opt to sublet their work for various compelling reasons such as financial benefits, workload pressures, human or plant resource constraints and better efficiency [8] [9] [10]. While the majority of the work in a project is carried out by a group of subcontractors, meeting the client requirements and achieving project success depend heavily on their performance [11]. As proposed by [2], attempts at applying the CSF approach to the field of construction management demonstrate its great potential for the identification of the few but vital factors to help reduce the complex nature of management issues. This will, in turn, make it easier to efficiently manage the success factors with the use of limited resources. [6] suggested that the CSF approach could be an effective method in the following two situations: (1) when the task is to reduce numerous factors in making a complex system manageable; and (2) if a large number of success factors are competing for limited resources, the CSF approach could help to identify those vital factors that should be given more attention.

A. Problem Statement

The factors which bring to the success of a construction project were determined by mainly four main aspects which are the projects' characteristics, contractual arrangements, projects' participants and interactive process [3]. On the other hand, every factor that affects the success of the construction projects can only be analyzed in general without taking the allocated project objectives into account [12]. In reality, these factors have different roles for different project objectives [13]. Generally, the quality of a project can only be improved when an interactive process is involved in the project. On the other hand, the constructability factor in a project has been identified as a factor which can save time and cost as well as increase the construction project quality [13]. They emphasized the optimum use of construction sources as the major factor to lead the success of construction projects.

There are clearly, many critical factors being identified for construction project success. However, different factors are critical towards different project objectives and as yet, there is no complete list as to the critical factors which lead to the success of construction projects based on the project schedule, budget and performance. The aim of this paper is thus, to identify the critical success factors for construction projects based on each project objective (time, quality and cost) and to recommend the best practices that can be implemented by Universiti Teknologi MARA (UiTM) contractors in Malaysia.

II. LITERATURE REVIEW

CSFs are the few key variables that the manager should prioritize in achieving his goals for current or future areas of activity. These key variables can be used in the company's planning process, in helping to improve communication among the managers or to aid the planning of information systems. As reported by [2] in [14]'s seminal work, critical success factors (CSFs) are "for any business, the limited number of areas in which results, if they are satisfactory, will ensure successful competitive performance for the organization. They are the few key areas where 'things must go right' for the business to flourish". At the strategic level, CSFs are defined as those few important things that an organization must do well to ensure success for a manager or an organization [15]. At the operational level, CSFs are those key issues that help to define whether an organization is achieving its goals and objectives in a changing environment.

As a result, the CSFs are areas of activity that should receive constant and careful attention from management. The current status of performance in each area should be continually measured, and that information should be made available".

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CSFs are vital elements from which effective strategies and positive outcomes can be derived [14] [15]. As the construction industry is characterized by its heterogeneity in project deliverables, researchers recognize the importance of identifying CSFs to warrant project success. Studies related to CSFs at the project level include (i) a comparison of the CSFs as perceived by the clients and contractors [16]; (ii) classification of CSFs for construction projects [20]; (iii) CSFs for an integrated building process model [13]; (iv) a hierarchical model for construction project success [3]; and (v) CSFs for alternative procurement options such as Build-operate-transfer (BOT) [19], build-own-operate-transfer (BOOT) [19], and public private partnerships (PPP) [5].

A categorization system is needed to identify specific methodologies for various projects [20]. Yet, whether different success criteria will be relevant for different types of projects, and hence different success factors, and whether different projects will perform differently against those different success criteria remain unclear.

In addition, in selecting project managers to manage their projects, project sponsors want to know that the manager will focus on the relevant success criteria of the project, and will be skilled in implementing the appropriate success factors. Thus the sponsor wants a project manager not just with the relevant competencies, [20], but also with a specific focus in their work. When selecting a contractor for any kind of project, clients need to consider not only technical competence but also organizational culture and personal traits of the contractor's personnel, such as trustworthiness, commitment, openness, and ability to communicate [21].

Project success criteria vary from one project to another [21]. What may be acceptable in one project without impacting perceived success can be abject failure in another. People judge the success of projects differently depending on their personal objectives, and it can be the case that one person judges a given project a success, while another judges it a failure [21]. They have also shown that the project managers' success at managing projects is dependent on their competence, particularly their leadership style comprising emotional intelligence, management focus and intellect. His or her leadership style can be measured using psychometric tests, but the question remains whether such differences are predictable from easily measured demographic factors.

There were two groups of key performance indicators for construction project success [22]. The first group comprises objective measures which were the issues of time; cost; safety; and the environment. The second group includes subjective measures which comprised quality; functionality; and satisfaction of different project participants. They tied the performance indicators with success criteria, but those indicators were limited to operational and tactical levels and excluded the strategic level of the projects. Similarly, [23] introduced success criteria for mass house-building projects which included: environmental-impact; customer's satisfaction; quality and overall cost; and time. These criteria also failed to target the strategic objectives of the contracting organization.

III. RESULTS AND DISCUSSION

120 questionnaires were distributed to the UiTM contractors registered under the UiTM Development Department which manages and controls the construction and development of the university. However, only 14 replies (12%) were received as most of the contractors had either not renewed their registration or had finished their respective projects with the university's branch campuses.

The results of the analysis of the respondents' personal profile and companies, analysis of the success factors of a construction project are based on the different project objective (Time, Cost Quality).

The majority of the respondents were from the middle management, accounting for 14 respondents (57%). These comprised higher management, middle management and lower management officers. The majority fell in the 31 – 40 age-group, accounting for 28% (4 respondents). This was followed by the 41 - 50 age-group which accounted for 22% (3 respondents). 7 respondents were categorized in the 51-60 age-group which is equivalent to 50%. There are no respondents in the 60 age-group and above. The findings show that majority of the respondents are matured and fully-experienced in the construction industry. All respondents (100%) originated from contractor backgrounds. The findings indicated that the analysed data was collected from the opinions of the same groups. Seven (7) respondents were involved in the firms which had been established for 10 years and above while 4 respondents (29%) were employed in the firms which had been established for 6-10 years. However, there were 2 respondents (14%) who worked in firms of less than 2 years and 2–5 years of establishment. The results of the analysis are deemed reliable since the majority of the respondents (50%) were from establishment firms of 10 years and more. Their experience in factors affecting project success can therefore be utilized.

B. Based On Project Characteristics – Time

Table 1 - Based of project characteristics – time

NO	TIME	SCORE	PERCENTAGE (%)	RANK
1	Site limitation and location	**157**	14	1
2	Project size	**149**	14	2
3	Adequacy of funding	**142**	13	3
4	Technical approval authorities	**138**	13	4
5	Pioneering status	**121**	11	5
6	Constructability	**114**	10	6
7	Economic risks	**100**	9	7
8	Political risks	**91**	8	8
9	Impact on public	**91**	8	9
		1103	100	-

Table 1 shows the UiTM contractors's view of the importance of site limitation which received the highest ranking of fourteen percent (14%) with the highest score (157). This is followed by project size, adequacy of funding, technical approval authorities, pioneering status, constructability, economic risks, political risks and impact on public.

Site limitation – Lack of space, horizontally and vertically, is one of the factors that contribute to complexity and uncertainty. This was supported by [24] who suggested that

limited space will further create problems especially to store construction materials and clarified that in every large project, new risks emerge, adding more considerations to the project size. According to [25], in achieving high performance, the uncertainties in project outcomes also increase as the size of the project multiplies. Moreover, large scale construction projects are exposed to uncertain environments because of such factors as planning and design complexity, presence of various interest groups such as project owner, owner's project group, consultants, contractors and resources availability [25].

Adequacy of funding and technical approval authorities received 3rd and 4th ranking. One of the most pressing problems in construction projects is the working capital and liquidity required to support daily site activities. It has been said that more contractors go out of business due to illiquidity to support their daily activities rather that technical incapability to perform the job. Inadequate funding will cause a project to suffer and therefore be delayed which is unfavourable to the concerned parties. Unplanned regional growth and consequent excessive bidding and work orders could result in the company's financial position being severely strained. This perpetual need for funds to fuel growth also calls for an effective project financing mechanism to manage the funds required.

Pioneering status and constructability were ranked 5th and 6th respectively while economic risks and political risks were placed 8th and 9th. Impact on the public was confirmed by 8 respondents as a factor that is not too critical for construction projects based on project characteristics.

C. *Based On Project Characteristics – Cost*

Table 2 - Based on project characteristics – Cost

NO	COST	SCORE	PERCENTAGE (%)	RANK
1	adequacy of funding	137	19	1
2	economic risks	119	16	2
3	site limitation and location	100	14	3
4	project size	77	10	4
5	political risks	70	10	5
6	technical approval authorities	69	9	6
7	constructabilit y	66	9	7
8	pioneering status	64	9	8
9	impact on public	34	5	9
		736	100	

Table 2 illustrates the UiTM contractors' huge concern regarding adequacy of funding, receiving the highest ranking (19%), with the highest score (137). Adequate funding for project completion is crucial as illiquidity may result in the project being heavily burdened. With inadequate cash flow to meet operating needs, the contractors have the right to stop work under the Security of Payment (SOP) Act upon non-payment and can even claim losses against the owner for work postponement. Feasibility studies and reviews of initial cost estimation by consultants can provide the basis for better project management, better preparation and cost and schedule control.

Table 2 also shows that economic risks received 16% at 2nd place and site limitation and location was placed third. The project size and political risks were in 4th and 5th place respectively. It was found that technical approval authorities and constructability were at 7th and 8th place while impact on public received the lowest score (37) and was placed 9th.

The importance of constructability as described by [25] from the owners' perspectives and the advantages it brings in terms of cost and time reductions optimizes other project objectives such as quality and safety.

D. *Based On Project Characteristics – Quality*

Table 3 - Based on project – quality

NO	QUALITY	SCORE	PERCENTAGE (%)	RANK
1	adequacy of funding	137	19	1
2	site limitation and location	130	18	2
3	economic risks	88	12	3
4	constructabi lity	77	11	4
5	project size	77	11	5
6	political risks	67	9	6
7	technical approval authorities	65	9	7
8	impact on public	41	6	8
9	pioneering status	41	6	9
		723	100	

Table 3 illustrates the UiTM contractors' confirmation that adequacy of funding was most important, receiving the highest ranking of 19% with the most scores (137). This was followed by site limitation (18%) with a score of 130. Economic risks and constructability received the 3rd and 4th place followed by constructability which showed a score of 11%. Project size and political risks were ranked 5th at 6th while technical approval authorities, impact on public and pioneering status were in 7th, 8th and 9th place respectively.

E. *Based On Contractual Arrangement – Time*

Table 4 – Based on contractual arrangement – time

NO	TIME	SCORE	PERCENTAGE (%)	RANK
1	Formal dispute resolution process	110	29	1
2	Adequacy of plans and specifications	102	27	2
3	Realistic obligation and clear objectives	90	24	3
4	Motivation and incentives	41	11	4
5	Risk identification and allocation	33	9	5
		376	100	

Table 4 shows that based on contractual arrangement on time, formal dispute resolution process received 29% with the highest ranking followed by adequacy of plans and specifications at 2nd place and realistic obligations and clear objectives with a score of 90. Ranked at 3rd place by the contractors, realistic obligations and clear scope are crucial to ensure the proper delegation of responsibilities. Clear objectives are essential because success is determined by how closely they are met. For the objectives to be effective, they ought to be both specific and measurable, and all project stakeholders should understand and officially agree to them. Realistic obligations, clear objectives and scope are important success factors for all projects since they help ensure the project team's commitment to project goals. Objectives relate to the project outcome while scope is concerned with the limits of the project. Nevertheless, they should not be considered separate entities because without a well-defined scope, the project objectives are unclear [28]. Definition and obligations should include a common understanding by all participants. This enables the project to be goal and results-oriented instead of activity based. Such measures allow for project progress to be effectively monitored. Also, measurement of success is simpler when objectives are clear set out. [25] stated that with a defined scope to limit the project boundaries, it is easier to identify the presence of scope creep and also reduces the possibility of missing a vital part of the project.

Motivation and incentives received a score of 41, denoting 11% and ranked 4th. [25] suggested that not only are financial incentives necessary to enhance motivation at personal and organizational level, they also promote unified motivation across highly interdependent and contractually fragmented project teams. The owners must therefore exercise caution in promoting financial incentives as a supporting tool in the development of trust, cooperation and motivation, instead of a performance control mechanism within highly detailed contractual specifications. Financial incentives can also enhance the positive impact of a range of other performance-enhancing initiatives, such as an equitable base contract, future work opportunities relationship workshops, up-front design involvement and value driven tender selection [28].

Risks in construction are due to the inherent uniqueness of every project. Construction projects are open systems, implying that the process of risk management has to be attuned to the collaborative environment. Risks should be an expected part of the construction process and it is crucial for organisations to identify potential sources of risk and to take steps to mitigate their exposure [29]. Such risks can prevent the accomplishment of time, cost and quality targets. As a result, the owner has to identify where the risks can be controlled and minimized. When the process is initiated at the earliest opportunity, controllable risks may be delegated quickly so that those responsible can take appropriate measures to eliminate or minimize them [27].

As posited by [24], plans were refer to official drawings or reproductions depicting the location, character, dimension and details of the work to be done and are part of the contract. Specifications relate to the part of the contract containing the written directions and requirements for completing the contract work. Adequately prepared plans and specifications support accurate cost estimates and work and significantly reduce the uncertainties during contractual negotiations, thereby minimizing project risks [30]. Defective or inadequate designs and specifications provide fertile ground for construction claims, and can result in unfavourable variations that may be both cost and time consuming. To avoid unnecessary construction claims, consultants are responsible for performing a constructability review and providing adequate plans and specifications before receiving contractor bids. Errors, omissions and conflicts are leading causes of disputes, change orders and subsequent claims

F. Based On Contractual Arrangement – Cost

Table 5– Based on contractual arrangement – Cost

NO	COST	SCORE	PERCENTAGE (%)	RANK
1	Adequacy of plans and specifications	72	28	1
2	Realistic obligation and clear objectives	64	25	2
3	Formal dispute resolution process	64	25	3
4	Risk identification and allocation	34	13	4
5	Motivation and incentives	25	10	5
		259	100	

Table 5 shows that adequacy of plans and specifications received 28% with the highest ranking followed by realistic obligation and clear objectives with 25% at 2nd place and formal dispute resolution process and risk identification ranked 3rd and 4th place. Motivation and incentives in fifth place with 10% where

G. Based On Contractual Arrangement – Quality

Table 6 – Based on contractual arrangement – Quality

NO	QUALITY	SCORE	PERCENTAGE (%)	RANK
1	Realistic obligation and clear objectives	73	29	1
2	Adequacy of plans and specifications	66	27	2
3	Formal dispute resolution process	65	26	3
4	Motivation and incentives	31	12	4
5	Risk identification and allocation	14	6	5
		249	100	

Table 5 shows that realistic obligations, clear objectives and scope are important success factors for all projects since they help ensure the project team's commitment to project goals. Objectives relate to the project outcome while scope is concerned with the limits of the project. Nevertheless, they should not be considered separate entities because without a well-defined scope, the project objectives are unclear [29]. Definition and obligations should include a common understanding by all participants. This enables the project to

be goal and results-oriented instead of activity based. Such allows for project progress to be effectively monitored. Also, measurement of success is simpler when objectives are clearly set out. [24] also suggested that with a defined scope to limit the project boundaries, it is easier to identify the presence of scope creep and also reduces the possibility of missing a vital part of the project.

H. Based On Project Participants – Time

Table 7 - Based on project participants – time

NO	TIME	SCORE	PERCENTAGE (%)	RANK
1	Suppliers	137	25	1
2	Subcontractors	93	17	2
3	Project managers	91	17	3
4	Contractors	84	16	4
5	Clients	72	13	5
6	Consultants	63	12	6
		540	100	

Table 6 shows that based on project participants on time, the supplier plays the major role with the highest percentage of 25% in delivering the material on site on time, followed by subcontractors, project manager, contractors, clients and consultants.

I. Based On Project Participants – Cost

Table 8 Based on project participants – cost

NO	COST	SCORE	PERCENTAGE (%)	RANK
1	Suppliers	96	24	1
2	Project managers	88	22	2
3	Contractors	81	20	3
4	Consultants	54	14	4
5	Clients	42	11	5
6	Subcontractors	36	9	6
		397	100	

Table 6 shows that based on project participants on time, the supplier also plays the major role with the highest percentage of 25%, followed by project manager, contractors, consultants, client and sub-contractor.

J. Based On Project Participants – Cost

Table 9 Based on project participants – quality

NO	QUALITY	SCORE	PERCENTAGE (%)	RANK
1	project managers	107	27	1
2	suppliers	86	22	2
3	contractors	69	18	3
4	consultants	56	14	4
5	subcontractors	46	12	5
6	Clients	30	8	6
		394	100	

Table 7 shows that based on project participants on cost, project managers played the most important role and was ranked 1st, followed by suppliers, contractors, consultants, subcontractors and clients.

K. Based On Interactive Process – Time

Table 10 Based on interactive process – time, cost and quality

NO	TIME	SCORE	PERCENTAGE (%)	RANK
1	Planning	81	39	1
2	Monitoring	66	32	2
3	Communication	33	16	3
4	Project organisation	29	14	4
		209	100	

Table 8, 9 and 10 shows that based on interactive process in relation to time, planning received the highest percentage of 39% and at 1st place followed by monitoring, communication and project organisation with 32% and 16%. However, project organisation was at 4th place with 14%. Construction planning is essential yet challenging.

According to [24], programs should be in place to cope with plans and scheduling. A thorough plan sets the basis for developing accurate budget and schedule estimates. A control process collects, measures, and present facts relating to time, cost and accomplishment of quality standards against the initial plan [28]. Project planning and control therefore helps contractors to reduce the chance of unexpected occurrences that disrupt the project progress. Modern computerised tools and project management training may be crucial to project planning.

IV. OVERALL ANALYSIS OF THE CRITICAL SUCCESS FACTORS FOR CONSTRUCTION PROJECTS

Table 11 – Overall project based on time, cost and quality

NO	TIME	SCORE	PERCENTAGE (%)	RANK
1	Interactive process	72	40	1
2	Project characteristics	45	25	2
3	Contractual arrangements	43	24	3
4	Project participants	21	12	4
		181	100	

Table 11 shows that the interactive process was ranked 1st with 40% and project characteristics was at 2nd place with 25%. The contractual arrangement and project participants were in 3rd and 4th place with 24% and 12% each. This shows that project success may be assured better when the owner and contractor firms work together as a team with established common objectives and defined procedures for collaborative problem solving [31].

[24] confirmed that similarly, such relationships should be extended to include all project participants. Hence, the

interactive processes shown in Table 10 become crucial in facilitating effective coordination throughout the project lifespan [3]. Communication refers to the sufficiency of communications channels, both formal and informal, and their efficacy at providing timely, adequate information to the appropriate project participants [24]. Monitoring deals with observing and reporting (feedback) on actual performance against expected progress. Control involves taking action to shape future events with the aim of accomplishing what has been initially planned [32].

V. CONCLUSION AND RECOMMENDATIONS

The result of the analysis found that there is a set of different critical success factors for the different objectives which are time, cost and quality. However, there are 6 factors that can be considered as critical for construction project success. From the project characteristics on time, cost and quality these factors were site limitation and location, project size, adequacy of funding, technical approval authorities, pioneering status, constructability, economic risks, political risks and impact on public. Conversely, based on contractual arrangement on time, cost and quality, it was found that formal dispute resolution process, adequacy of plans and specifications, realistic obligations and clear objectives, motivation and incentives, risk identification and allocation were influencing critical factors. Based on interactive process on time, cost and quality, it was found that planning, monitoring, communication and project organisation were crucial. Finally, based on the overall project based on time, cost and quality, it was found that interactive process, project characteristics, contractual arrangement and project participants were of importance. These different sets of critical success factors for the different objectives (time, quality and cost) were critical towards the success of the projects carried out by Contractors.

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