CRITICAL SUCCESS FACTORS FOR DIFFERENT ORGANIZATIONS IN CONSTRUCTION PROJECTS

Asfandyar Inayat, US-Fulbright Scholar, ayi@ksu.edu
Hani Melhem, PhD., PE, F. ASCE, Professor, melhem@ksu.edu
Department of Civil Engineering, Kansas State University, Manhattan, KS 66503

ABSTRACT

Consensus exists among researchers that most reasons for project success can be attributed to the presence or absence of certain project characteristics. These project characteristics, referred to as critical success factors (CSFs), require special attention from management owing to their impact on project performance. The present study aims at differentiating the CSFs based on organizational backgrounds of project participants (Contractor, Project Management Organization, and Consultant), which have not been touched upon before. A survey was offered to construction professionals to rank a list of 53 potential factors. The list includes, in addition to the CSFs of Kog and Loh (2011), potential-factors that were shortlisted after in-depth interviews with experts who have worked in both developed and developing countries. The professionals include civil/structural engineers, architects, mechanical engineers, electrical engineers, and quantity surveyors who have worked in the construction industry in the capacity of consultants, contractors, and managers. Participating in the survey are professionals having experience both in developed countries like Canada, UK, and the USA, as well as in developing countries, namely Pakistan, Saudi Arabia, and the UAE. This research will serve as preparatory work for the purpose of developing a project management support system.

Keywords: Critical success factors, Organizational backgrounds, Project perceived success

1. INTRODUCTION

A project is a costly, complex and high risk undertaking that needs to be completed within some expected levels of performance, and has limitations of time and money attached to it. Management of a project involves allocation of only those resources to the project that are felt essential at a particular time, and to ensure that the allocated resources are utilized to the optimum level (PMH 1983).

Consensus exists among researchers that most reasons for project success can be attributed to the presence or absence of certain project characteristics. These project characteristics, referred to as critical success factors (CSFs), require special attention from management owing to their impact on project performance. The term 'critical success factors' was introduced to the field of project management by Rocart in 1982 who defined it as "*Those few areas of activities in which favorable results are absolutely necessary for a particular manager to reach his or her goals* (Rocart 1982)"

Researchers initially perceived a common set of factors to be critical to the success of all project types (Manufacturing, R&D, Construction, etc.). In contrast practitioners felt that much in the form of generalized project management prescriptions offered to them was inapplicable to the peculiar problems posed by their respective classes of projects. Consequently, conclusions of researchers would often be ignored by practitioners. Setting aside this serious dichotomy between theory and practice, Pinto and Covin (1989) concluded that researchers must descend from broad generalizations by taking into account the peculiarities of various classes of projects.

Construction projects pose a unique scenario in that they are characterized by a diversity of events and interactions between changing participants such as civil engineers, architects and mechanical/electrical engineers. Kog and Loh (2011) studied a possible dissimilarity between CSFs pertaining to different components of construction projects: (1) civil works, (2) architectural works, and (3) mechanical and electrical works. They concluded that, on the whole, markedly distinct sets of factors were perceived as crucial by professionals associated with these three components. On the whole, not much research has been conducted on the effects of organizational background on CSF formulation. The present study aims at differentiating the CSFs based on organizational backgrounds of project participants: contractor, project management, and consultant organizations.

Before the methodology for this research is explained in the next section, it would be useful to shed some light on the procedures adopted in CSF determination. It is the combination of performance criteria, project participants, and likely consideration of project phases that distinguishes one research from another. Selection of objectives actually depends on the set of stakeholders that are considered for a study; after having decided the stakeholders and objectives, a researcher sets to the task of generating the CSFs. Of the different methods employed for CSF identification, 'soliciting expert opinion' is worth mentioning. 'Expert opinion' has been employed with the following distinct approaches:

- Approach-1 (Expert opinion): Respondents are asked to identify a set number of factors that they consider critical to project success, and then indicate their relative importance (Pinto and Slevin 1987). This is followed by a two pronged task by expert professionals: (1) Interpreting the essence of the factors as the same factor may have been stated quite distinctly by different respondents, and (2) Extract those factors as CSFs that have been stated with the highest frequency of respondents. Since it is not easy to read the mind of the respondents with a good degree of accuracy, it would rather be too much to expect that the experts would have understood the nomenclature and scope of the factors identified by the respondents.
- Approach-2 (Expert opinion): Factors are extracted from available past literature and then shortlisted based on in-depth interviews with experts from the profession to which the research relates—The shortlisting results in what is commonly referred to as 'potential factors'. A survey questionnaire, essentially comprising potential factors and objectives is then presented for assessment to professionals from the related field. The completed questionnaires form a database that is analyzed for the CSFs. Researchers seek the assessment in the following two ways:
  a) The experts can be asked to rank the potential factors based on a predetermined scale (Chan and Kumaraswamy 1997)
  b) The experts may be asked to conduct a pair-wise comparison of all possible pairs of factors so that a database for the Analytical Hierarchy Process can be generated (Chua *et al.* 1999; Kog and Loh 2011).

2. METHODOLOGY

2.1 Survey and Respondents

A survey was offered to construction professionals to rank a list of 53 potential factors Table A.1 (see Appendix A). The list includes, in addition to the CSFs of Kog and Loh (2011), potential-factors that were shortlisted after in-depth interviews of experts who have worked in both developed and developing countries. The nomenclature of some of the factors is explained in Table A.2, the other being self-explanatory. The professionals include civil/structural engineers, architects, mechanical engineers, electrical engineers and quantity surveyors having work experiences in consultant firms (design firms), contractor firms, and project manager organizations (construction management firms) in the construction industry. The survey was offered to professionals having experience both in developed countries like Canada, UK and USA, and developing countries namely Libya, Pakistan, Saudi Arabia, and UAE.

2.2 Conversion of Classificatory Data to Absolute Form

Because of the subjective nature of the data, this study chooses the Analytical Hierarchy Process (AHP) to analyze the completed questionnaires. Depending on the circumstances, the AHP can be used for analyzing *comparative judgments* or *absolute judgments*. In the *comparative judgment* procedure, the AHP uses absolute scale numbers (Table 1) for judgments of factors and returns the absolute values for priorities. Alternately, it is possible to solicit from experts an *absolute judgments/ratings* of factors on an intensity level, conduct a pairwise comparison of intensity levels (rather than factors), and assign the resulting priority values to the absolute judgments. In both methods the priorities ultimately becomes relative upon normalization or idealization (Saaty 2006).

Table 1. Fundamental Pairwise Comparison Scale [Saaty 2006]

Level of Importance	Definition	Explanation
1	Equal importance	The two nodes contribute equally to the parent
3	Moderate importance	Judgment moderately favors the strong over the weak
5	Strong importance	Judgment strongly favors the strong over the weak
7	Very strong demonstrated importance	The stronger node's importance over the weaker is demonstrated very strongly in practice.
9	Extremely strong demonstrated importance	Extremely strong evidence exists for favoring the stronger over the weaker node.

Values 2,4,6,8 can be used for intermediate intensities between above-stated levels of importance

Rather than asking the experts to conduct a pairwise comparison of factors, they were requested to rate the factors based on their ability to determine schedule, budget and quality performances. A five-level intensity scale was to be employed by the experts: Excellent, above average, average, below average, and poor.

Pairwise comparison matrix and the resulting idealized priority vector for the 5-levels of intensity are computed as below:

A=

	Excellent	*Abv Avg*	*Avg*	*Blw Avg*	*Poor*
Excellent	1	5	6	8	9
Abv Avg	1/5	1	4	5	7
Avg	1/6	1/4	1	3	5
Blw Avg	1/8	1/5	1/3	1	4
Poor	1/9	1/7	1/5	1/4	1

⇓

	Norm-PV		Ideal-PV
Excellent	0.57		1.00
Abv Avg	0.23		0.41
Avg	0.11	====>	0.19
Blw Avg	0.06		0.11
Poor	0.03		0.05

2.3 Determining Objective-wise Performance

Considering one organization-type at a time, hypothesis testing is employed to determine the factors that have a significant impact on each of schedule performance (s), budget performance (b), and quality performance (q). Spearman rank correlation coefficient (r_s) is used to test the null hypothesis, H_o ($\mu_1=\mu_2$): objective (Schedule, Budget, or Quality) is independent of factor (f_1 to f_{53}), is tested against the alternate hypothesis, H_A: objective (Schedule, Budget, or Quality) is positively correlated to factor (f_1 to f_{53}). The alternate hypothesis would be accepted if the calculated p-value is less than 0.05. This implies that for the alternate hypothesis to be accepted, the following conditions must be satisfied:

- Contractor organization (21 professionals): $r_s \geq 0.368$
- Consultant organization (9 professionals): $r_s \geq 0.600$
- Project Management Organization (14 professionals): $r_s \geq 0.456$

2.4 Determining Overall Performance

The idealized priority values were assigned to the intensity levels of the 53 factors for the objectives of budget, schedule and quality performance as assessed by each expert. This was followed by determining the priority values and rankings for overall project success. χ^2 values for the of rankings were calculated to ascertain the level of association between experts hailing from the same organizational background. Priority values of experts from the same type of organization were only averaged if calculated value of χ^2 was more than the relevant critical value at 95% level of confidence.

3. RESULTS

3.1 Contractor Organization

Factors satisfying the alternate hypothesis for an objective (schedule, budget or quality) imply that they have a capacity to significantly determine the particular objective. Table 2 shows significant factors for schedule performance, budget performance, and quality performance for the contractor organizations. The factors of realistic obligations/clear objectives, adequacy of plans and specifications, capability of contractor key personnel, construction control meetings, and site inspections were seen to be commonly significant for all the three objectives. The factors of technical approval authorities, site access limitation, and latent site conditions were commonly significant for schedule and budget performance. The factors of economics risks, capability of consultant key personnel, competency of consultant proposed team, design complete at construction start, level of automation, and transparency in awarding of work were seen to be commonly significant for budget and quality performance.

The factors that were significant for schedule but not for budget and quality performance were: adequacy of funding, contractual motivation/incentives, informal construction communication, schedule updates, and bureaucratic involvement. The factors that significantly contributed only to budget performance were functional plan, general tolerance to corruption, and absence of litigations/claims. The factors that significantly contributed only to quality performance were constructability, pioneering status, project size, PM competency, PM authority, PM commitment and involvement, competency of contractor proposed team, and level of skill labor required.

3.2 Project Management Organization

Table 3 shows significant factors for schedule performance, budget performance, and quality performance for the project management organizations. Of the 53 factors, 19 were significant contributors to schedule performance, 12 were significant contributors to budget performance, and 20 were significant contributors to quality performance. The factors of capability of contractor key personnel, capability of consultant key personnel, level of skill labor required, and site access limitation were seen to be commonly significant for all the three objectives. Capability of client key personnel, recruitment and training procedures, and

latent site conditions were commonly significant for schedule and budget performance. Economics risks, adequacy of plans and specifications, pioneering status, project size, level of modularization, construction control meetings, and schedule updates were commonly significant for schedule and budget performance. The factor of functional plan was commonly significant for budget and quality performance.

Table 1. Contractor Organization Significant Factors

Potential Factor	**Significant at 5% for Contractor Personnel**					
	Schedule		Budget		Quality	
	r_s	*p-val*	r_s	*p-val*	r_s	*p-val*
Realistic Obligations	0.45	*0.020*	0.55	*0.004*	0.42	*0.026*
Adequacy of Plans & Specifications	0.49	*0.012*	0.61	*0.002*	0.38	*0.044*
Capability of Contractor Key Personnel	0.40	*0.037*	0.49	*0.012*	0.44	*0.024*
Construction Control Meetings	0.62	*0.001*	0.37	*0.049*	0.47	*0.015*
Site Inspections	0.60	*0.002*	0.55	*0.005*	0.43	*0.026*
Technical Approval authorities	0.41	*0.032*	0.56	*0.004*		
Site Access Limitation	0.39	*0.040*	0.41	*0.032*		
Latent Site Conditions	0.43	*0.025*	0.43	*0.026*		
Economics Risks			0.43	*0.025*	0.41	*0.032*
Capability of Consultant Key Personnel			0.47	*0.016*	0.38	*0.044*
Competency of Consultant Team			0.49	*0.011*	0.62	*0.001*
Design Complete			0.50	*0.010*	0.42	*0.028*
Level of Automation			0.55	*0.005*	0.68	*0.0003*
Transparency in work award			0.42	*0.030*	0.66	*0.0005*
Adequacy of Funding	0.48	*0.014*				
Contractual Motivation	0.43	*0.027*				
Informal Construction Communication	0.49	*0.012*				
Schedule Updates	0.45	*0.020*				
Bureaucratic Involvement	0.42	*0.040*				
Functional Plan			0.52	*0.007*		
General Tolerance to Corruption			0.42	*0.029*		
Absence of Litigations			0.40	*0.034*		
Constructability					0.56	*0.004*
Pioneering Status					0.64	*0.001*
Project Size					0.58	*0.003*
PM Competency					0.43	*0.025*
PM Authority					0.43	*0.025*
PM Commitment and Involvement					0.53	*0.006*
Competency of Contractor Team					0.37	*0.047*
Level of Skill Labor Required					0.66	*0.0006*

Table 2. PM Organization Significant Factors

Potential Factor	**Significant at 5% for PMO:**					
	Schedule		Budget		Quality	
	r_s	*p-val*	r_s	*p-val*	r_s	*p-val*
Site Access Limitation	0.77	*0.001*	0.53	*0.026*	0.49	*0.044*
Capability of Contractor Key Personnel	0.47	*0.044*	0.47	*0.044*	0.67	*0.004*
Capability of Consultant Key Personnel	0.68	*0.004*	0.82	*0.000*	0.48	*0.040*
Level of Skill Labor Required	0.84	*0.000*	0.65	*0.005*	0.60	*0.012*
Capability of Client Key Personnel	0.47	*0.044*	0.47	*0.044*		
Recruitment and Training	0.56	*0.018*	0.47	*0.044*		
Latent Site Conditions	0.53	*0.026*	0.50	*0.034*		
Economics Risks	0.79	*0.0004*			0.71	*0.002*
Adequacy of Plans & Specifications	0.47	*0.044*			0.48	*0.044*
Pioneering Status	0.51	*0.031*			0.77	*0.001*
Project Size	0.60	*0.011*			0.47	*0.045*
Level of Modularization	1.00	*0.000*			0.67	*0.004*
Construction Control Meetings	0.82	*0.0002*			0.67	*0.004*
Schedule Updates	0.68	*0.004*			0.48	*0.040*
Functional Plan			0.82	*0.0001*	0.84	*0.000*
Constructability	0.63	*0.008*				
Informal Construction Communication	0.58	*0.015*				
Design Complete	0.52	*0.029*				
Level of Automation	0.59	*0.013*				
Transparency in Work Award	0.59	*0.013*				
Budget Updates			0.62	*0.009*		
General Tolerance to Corruption			0.47	*0.044*		
Competent Authority Discretionary Powers			0.74	*0.001*		
Absence of Litigations			0.62	*0.009*		
Realistic Obligations	0.47	*0.044*			0.60	*0.012*
PM Competency					0.48	*0.040*
PM Authority					0.67	*0.004*
PM Commitment and Involvement					0.47	*0.043*
Competency of Client Team					0.73	*0.001*
Competency of Contractor Team					0.67	*0.004*
Competency of Consultant Team					0.79	*0.0004*
Site Inspections					0.47	*0.040*

The factors that were significant for schedule but not for budget and quality performance were constructability, informal construction communication, design complete at construction start, level of automation, and transparency in awarding of work. The factors that significantly contributed only to budget performance were budget updates, general tolerance to corruption, competent authority discretionary powers, and absence of litigations. The factors that significantly contributed only to quality

performance were realistic obligations, PM competency, PM authority, PM commitment and involvement, competency of client proposed team, competency of contractor proposed team, competency of consultant proposed team, and site inspections.

3.3 Consultant Organization

The term consultant organization refers to design firms. The analysis of the consultant organization could not be completed in time before the submission deadline of this paper. Spearman's test would be conducted for responses received from design firms on the same lines and patterns as has been done for contractor and project management organizations. The process is currently underway, and results would be published at a later stage.

4. DISCUSSION

Interestingly for the contractor personnel, while schedule updates was significant for schedule performance, budget updates could not prove significant for budget performance. However, for the project management personnel (managers), while budget updates was significant for budget performance, schedule updates proved as significant for both schedule and quality performances. It is also interesting to note that, as against previous research findings (Chua *et al.* 1999), site inspection was considered by contractor personnel to have significant contribution not only for quality performance but also for budget and schedule performances. The managers, on the other hand, held site inspection as significant only for quality performance.

A somewhat varying trend between contractor personnel and managers was witnessed with regard to factors that have a finance related background. Adequacy of funding was held as significant at 5% level of confidence for schedule performance by the contractor personnel but not by the managers. Whereas the contractor personnel considered economic risks as significant for budget and quality performances, the managers held the factor as significant for schedule and quality performances.

Networking techniques such as Critical Path Method (CPM) and Program Evaluation Review Technique (PERT) are generally considered being synonymous with project management. A combined previous research on construction, research and development (R&D), and manufacturing projects (Murphy *et al.* 1983) suggested that overuse of networking techniques, rather than being helpful is detrimental to successful implementation of projects. The particular finding had been justified by quoting the case study of a satellite program whose complex and time consuming network actually hampered its initial success. The factor 'overuse of networking techniques' was retested in this study by particularly presenting it to the respondents as 'initial overuse of CPM/PERT.' This was done for two reasons: (1) the said earlier research comprised construction projects only as a part of the whole study, and (2) with the advent of computerization, complexity of CPM/PERT may not be an issue in today's timeframe. Though the second reason may seem to have sufficient anecdotal evidence, it still needed to be researched empirically. Remarkably, the factor of 'initial overuse of CPM/PERT' proved as significant neither for the contractor personnel nor for managers- Surprisingly, this held true for schedule as well as budget performance. While this finding clearly testifies that both contractors and managers do not consider early overuse of CPM/PERT as a significant determinant of construction project success, it does not essentially down play importance attached with sensible and continued use of networking techniques.

A comparative study by Pinto and Covin (1989) had shown that as opposed to R&D projects, construction projects did not hold significance for the factor of 'project team personnel.' It was claimed that as compared to R&D projects, construction projects are more routine and less innovative, and hence the need of trainings for construction personnel does not essentially arise. With regard to an increase in the complexity of construction projects over time, this study deemed it necessary to retest the factor by presenting it to the respondents as 'recruitment and training.' It revealed that though the factor was not significant for the contractor personnel, it did hold significance for the managers for both schedule and budget performance.

It is comprehendible as to how schedule performance for contractors lies at the mercy of adequacy of funding and site inspections. The factor 'adequacy of funding' refers to timely provision of monitory resources by the owner to the contractor as an acceptance of the work done by the later. In the event that regular inspections are not conducted by the consultant to witness the completed work, and certify its required conformity to the plans and specifications that the consultant had framed in the contract documents, the contractor's ability to finance upcoming construction activities would be adversely affected. Delayed 'site inspections' by the consultant are bound to trigger a reduced 'adequacy of funding' for the contractor, which in turn negatively affects the schedule performance of the project.

Analogous to the dependence of schedule performance on site inspections, as seen by the contractor's personnel, is the explanation of the dependence of budget performance and quality performance on site inspections, capability of consultant key personnel, and competency of consultant proposed team. Timely observations of consultant during site inspections act as a blessing in disguise for the contractors. Late intimation about divergence from plans and specifications would magnify the cost that the contractor would have to incur on redoing rejected work.

The factor of economic risks refers to changes in prices of labor, materials and equipment. While a deflation is rare to occur, inflation in the economy affects an investor's profit margin drastically. The higher the investment, the more is the risk associated with inflations. Compared to PMOs and consultants, contractors have a much bigger financial stake involved in construction projects, and are hence at the higher risk of inflation. The evil of inflation spares no type of contract- for lump sum and guaranteed maximum contracts, it causes a reduced profit (to say the least) on investment of the contractor; for cost plus fixed fee contracts, though the contractor would receive a larger sum as a profit but with a reduced purchasing power. Unless contract agreement allows compensation for escalations, the contractor's ability to ensure project quality would undoubtedly deteriorate. No wonder why economic risks demonstrated a strong significance for the contractor organizations regarding quality and budgetary performance.

Formal construction communications requires that all correspondences between the contractor and owner, or those between the contractor and designer (architect/engineer) be routed through the field representative of the owner, designer or the construction manager firm. Such a designated field representative is commonly referred to as the Resident Project Representative (RPR). Inheriting authority from his/her employer, the RPR is responsible for a wide range of subjects- scheduling, cost control, quality control through field inspections, ensuring work done according to established plans and specifications, reviewing contractor payment requests, verifying contractor claims, and project coordination. The RPR's authority by far is limited, as for instance the contractor's demand for a change of specification, if justifiable, can only be accorded by the project manager (located at the home office and overseeing an array of projects); the RPR merely communicates the contractor's demand to the PM, receives the PM's decision, and communicates it back to the contractor. As field situations often require, oral communication (of course to be followed by paper work) provides for the quickest mode of decision making, and hence prevents avoidable delays. The contractor personnel's and managers' desire of informal construction communication for schedule performance originates from this very principal.

5. CONCLUSIONS

Some useful unique inferences for the organization types were observed. For instance, while contractor personnel are aware of the importance of site inspections for quality performance, they also deem it essential for maintaining their cash flows (budget performance) which in turn affects their productivity (schedule performance). Another unique inference is the managers' attachment of significance to training for schedule and budget performances that indicates that construction management is not a set of routine activities as it had been previously thought of- It is innovative and complex in nature. Also, contractor personnel's attachment of a high significance to bureaucratic involvement and technical approval authorities for schedule performance emanates from the reality that the responsibility of obtaining technical approvals primarily lies on their shoulders.

Some interesting commonalities of results between the organization types are worth mentioning. The fact that both contractor personnel and managers hold latent site conditions as critical for schedule and budget performances indicates that no amount of initial investigations and surveys can eliminate the possibility of unforeseen site conditions. The finding that both the managers and contractor personnel hold capability of contractor key personnel as significant for all the three objectives testifies that project success without able leaders in contractor team is nothing but wishful thinking. Similarly, Both managers and contractor personnel are in agreement over the role that the three PM related factors play in ensuring quality performance. The importance of Informal construction communications shall not be underestimated as both the managers and contractors value it as an asset for good schedule performance. Furthermore, unless contract agreement allows compensation for escalations, the contractor's ability to ensure project quality would undoubtedly deteriorate; No wonder why economic risks demonstrated a strong significance for the managers and contractor personnel regarding quality performance. Lastly, as would be expected both the managers and contractor personnel testify the significant impact of absence of litigations and general tolerance to corruption on budget performance.

ACKNOWLEDGMENTS

Since thanks is due to the US Fulbright Commission for honoring me with their prestigious scholarship that allowed me to pursue my academic and research goals, and be a proud alumni of Kansas State University.

APPENDIX A – Factors Used in the Surveys

Table A.1 List of 53 Potential Factors Considered in the Study

Project Characteristics	Political Risks, Economics Risks, Public Opinion, Technical Approval Authorities, Adequacy of Funding, Site Access Limitation, Constructability, Pioneering Status, Project Size.
Contractual Arrangement	Realistic Obligations/Clear Objectives, Adequacy of Plans and Specifications, Formal Dispute Resolution Process, Contractual Motivation/Incentives.
Project Participants	PM Competency, PM Authority, PM Commitment and Involvement, Capability of Client Key Personnel, Competency of Client Proposed Team, Client Top Management Support, Client Track Record, Capability of Contractor Key Personnel, Competency of Contractor Proposed Team, Contractor Top Management Support, Contractor Track Record, Capability of Consultant Key Personnel, Competency of Consultant Proposed Team, Consultant Top Management Support, Consultant Track Record.
Interactive Process	Formal Design Communication, Informal Design Communication, Formal Construction Communication, Informal Construction Communication, Functional Plan, Design Complete at Construction Start, Constructability Program, Level of Modularization, Level of Automation, Level of Skill Labor Required, Budget Updates, Schedule Updates, Design Control Meetings, Construction Control Meetings, Site Inspections.
Miscellaneous	General Tolerance to Corruption, Bureaucratic Involvement, Transparency in Awarding of Work, Post-award Impartiality, Competent Authority Discretionary Powers, Recruitment and Training Procedures. Absence of Litigations/Claims, Initial Overuse of CPM/PERT, Force Majour, Latent Site Conditions.

Table A.2 Explanation of Important Factors

Factor	Explanation
Economic Risks	Refers to changes in prices of labor, materials and equipment.
Technical Approval Authorities	Refers to Bureaucratic involvement.
Public Opinion	Refers to involvement of public primarily in public projects.
Pioneering Status	The extent of familiarity of project team to new methodology used in the project. A project is of pioneering status if methodology used in the project is new to the project team.
Realistic Obligations	Expecting a productivity level (from project team members) which is within achievable limits.
PM Competency	Refers to Administrative, technical and interpersonal skills of the PM.
Top-management Support	Willing of top management to provide necessary resources and authority to lower staff for effective performance of their tasks. (In a project management organization, the top management includes all the hierarchy above the level of project managers. The same analogy applies to client organization, consultant organization and contractor organization).
Functional Plan	Detailed plans for schedule, budget and resource allocation.
Level of Modularity	Refers to the construction of an object by joining together standardized units to form larger compositions.

REFERENCES

Chan, D.W.M., and Kumaraswamy, M.M. (1997). "A comparative study of causes of overruns in Hong Kong construction projects." *International Journal of Project Management*, 15(1), 55-63.

Chua, D.K.H., Kog,Y.C., and Loh, P.K. (1999). "Critical Success Factors for different project objectives." *Journal of Construction Engineering and Management, ASCE*, 125(3), 142-150.

Kog, Y.C., and Loh, P.K. (posted ahead of print August 10, 2011.). "Critical Success Factors for different components of construction projects." *Journal of Construction Engineering and Management, ASCE*, doi: 10.1061/(ASCE)CO.1943-7862.0000464.

Murphy, D.C., Baker, B.N., and Fisher, D., (1983). "Factors affecting project success." *Project management handbook*, D.I. Cleland and W.R. King, eds., Van Nostrand Reinhold, New York, 1983, 669-685.

Pinto, J.K., and Covin, J.G. (1989). "Critical factors in project implementation: a comparison of construction and R&D projects." *Technovation*, **9**(1), 49-62.

Pinto, J.K., and Slevin, D.P. (1987). "Critical factors in successful project implementation." *IEEE Transactions on Engineering Management*, **34**(1), 22-27.

Project Management Handbook (1983), 2nd edition, D. I. Cleland and W. R. King, eds, Van Nostrand Reinhold, New York, 479-512.

Rocart, J.F. (1982). "The changing role of information systems executive: A critical success factors perspective." *Sloan Management Review*, **24**(1), 3-13.

Saaty, T.L. (2006). "Rank from comparisons and from ratings in the analytical hierarchy/network processes." European Journal of Operational Research, **168**, 557–570.