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Future criteria for success of building projects in Malaysia

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Abstract

Several success criteria (SC) and categorization models have been introduced and studied in the previous decades to address the issue of project success. However, most of these models have failed to align success criteria with company's success in the long-term. This paper aims at proposing a framework to categorize project success for building projects in Malaysia from the contractors' perspective. The proposed framework incorporates criteria that align the project efforts with both short and long-term goals of the companies; moreover provide an appropriate judgment of success at all stages of the project. If construction managers can judge the probability of success, they would be able to evaluate the overall relative strength of each project, and identify problems on current projects to direct them toward success.

Based on the available literature, thirteen success criteria were found to be significantly and substantially related to building projects success. To develop the SC categorization framework, 151 participants, who are involved in building construction, were invited through a postal and e-mails survey to generate priorities of these criteria. The results of this study indicated that a categorization scheme for success criteria for building projects should include the categories of project management success, product success, along with market success. The findings of this study can further help future researchers seeking solutions in the challenges relating to improvement of building projects implementation and enhancement of project success.

Keywords: Success criteria; Project success; Factor analysis

1. Introduction

Building construction is considered to be an essential element of the construction industry in Malaysia, and it forms about 67.6% of the overall construction work (CIDB, 2008). The new global challenges thus call for greater focus on building capabilities. Building companies cannot solely focus on short-term goals as future goals of the business may be neglected. Making sound strategic decisions require new measures in evaluating the success of building projects that will support contractors and managers to enhance their competitive edge. It is very important for contractors to adopt more effective and comprehensive evaluating methods to identify problems and innovate ways of delivering successful projects. This can to be achieved with clarity of the success criteria that promote investment for the future. Hence, there is a need to answer this question: What are these criteria that are needed for the success of projects from the perspective of contractors? This paper seeks to answer this question through an empirical study.

The main objective of this research is to propose a framework for evaluating the success of building projects from the perception of a contractor. A literature search was used to generate the initial set of perceived success criteria, which were administered to the building construction companies via a postal and e-mail survey. A statistical analysis of the collected survey responses provided information for the identification of a set of success criteria by the management and experience level.

The findings from this research seek to raise the awareness of contractors and managers regarding the appropriate and comprehensive judgment on the success of building project. In addition, the proposed framework can help building contractors

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and managers to provide a better service as well as gain a strategic competitive advantage.

2. Review of project success

The criteria of time, cost, and quality have long been used to evaluate the performance and success of construction projects (Chan et al., 2002). Atkinson (1999) has named these criteria "the iron triangle". Although these basic criteria (i.e. cost, time and quality) are easy and timely to measure (Willard, 2005), they have been criticized for being inadequate for several reasons. Shenhar et al. (1997) said that the traditional criteria (i.e. cost, time and quality) were not really one homogeneous dimension. Shenhar et al. (1997) added that while meeting project resource constraints (time and cost) is one thing, meeting specifications (quality) is another. Alarcon et al. (1998) have argued that these basic criteria are not appropriate for continuous improvement because they are ineffective in identifying the causes of productivity and quality losses. These parameters do not provide an adequate vision of the potential for improvement and the information obtained usually arrives too late for corrective action to be taken. Project success is a strategic management concept where project efforts must be aligned with both short and long-term goals of the company. Likewise, strategic project management has been comprehended as a critical issue for project success (Rodrigues and Bowers, 1996). Atkinson (1999) considers the criteria of cost, time and quality as temporary criteria measurement for measuring efficiency during the delivery stage. Dweiri (2006) has shared Atkinson's opinion and looked at the basic criteria as internal measures of project management efficiency. Similarly, Shenhar et al. (2001) have considered the criteria of cost; time; and quality, as a measurement of success in the short run when time to market is critical.

Limitations of the traditional way of measuring success is clearly known and researchers have started to talk about introducing new success measures, such as participants' satisfaction (Pocock et al., 1996), satisfaction of interpersonal relations with project team members (Pinto and Pinto, 1991), stakeholders' satisfaction (Belout, 1998; De Wit, 1988; Lim and Mohamed, 1999) and client satisfaction (Lim and Mohamed, 1999). However, there are very few studies in project management literature that went beyond traditional thinking in measuring project success; in addition, mostly focused on industrial projects or did not fully address construction projects. For instance, the empirical study conducted on industrial projects by Shenhar et al. (1997), revealed four distinct dimensions: project efficiency; impact on customer; business and direct success; and preparing for the future. Later, Shenhar et al. (2001) demonstrated how these dimensions vary according to time and the level of technological uncertainty involved in the projects. Fig. 1 merged the success dimensions (Shenhar et al., 1997) within time frame (Shenhar et al., 2001). This figure shows the dynamics of the success assessments, and how the nature of success measurement alters with time. For example, the first dimension can be assessed in short-term, during a project's execution or after its completion. While the second dimension can be assessed after a medium time, when the project has been carried out and delivered to the customer. As for the other two dimensions, they can be assessed after a longer time.

Another significant study conducted by Atkinson (1999), which divided the project into three stages. In view of the Fig. 2, which illustrates these stages, it can be seen that the first stage was the delivery stage. This stage focused upon the task of project management, and doing things right. The next stage was the post delivery that was concerned with the system, and measured the benefits to the resultant organisation (direct benefits). The third stage was the post delivery, which measured the benefits to a wider stakeholder community (indirect benefits).

Atkinson (1999), Shenhar et al. (1997) and Shenhar et al. (2001) have made significant contributions to knowledge management and moved away from the traditional way in measuring the success by focusing only on time, budget, and quality. Yet these studies have addressed projects of various industries

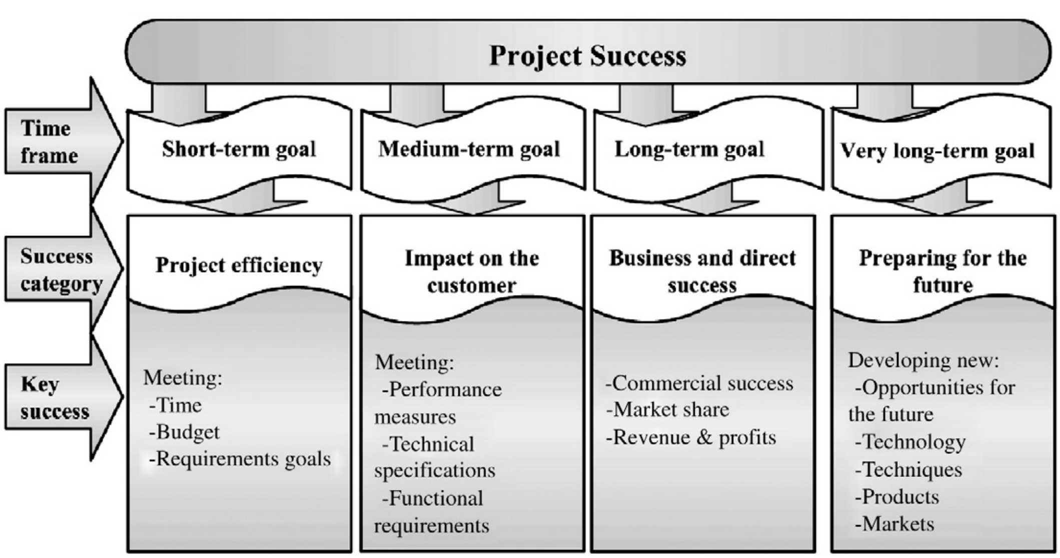

Fig. 1. The four dimensions of project success. Based on Shenhar et al. (1997, 2007).

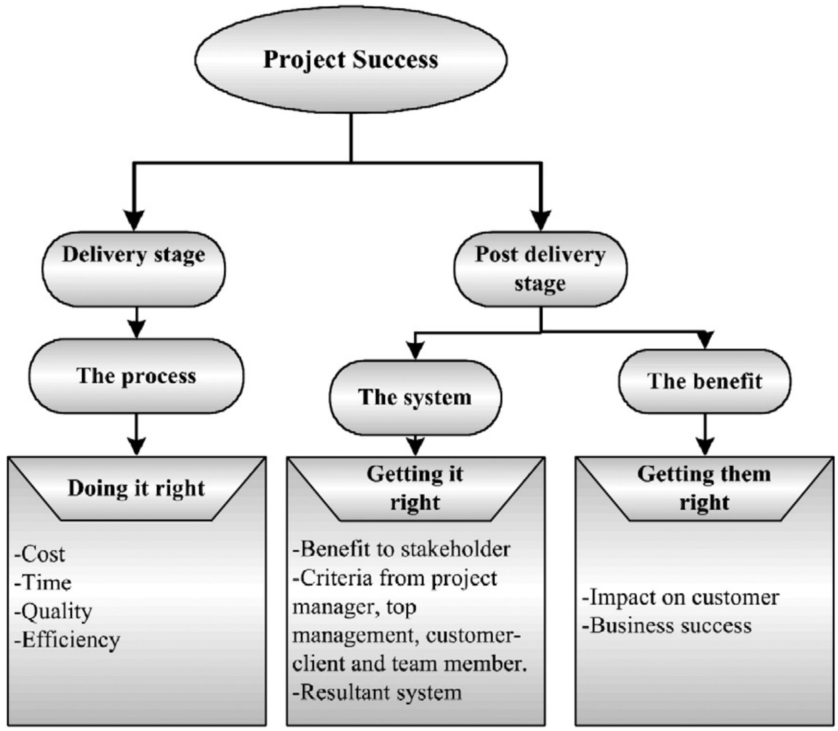

Fig. 2. Measuring project success. Based on Atkinson (1999, p. 339).

rather than focused on construction projects. Since the success criteria will vary from project to project (Hannola et al., 2009); those measures do not address the issue of success of building projects.

3. Success criteria of construction projects

Within the construction industry, the concept of project success has remained ambiguously defined (Brown and Adams, 2000; Chan and Chan, 2004). However, there are many attempts to explore the concept of success and to develop different frameworks for measuring the success of construction projects. For example, Lim and Mohamed (1999) have looked at construction project success from the macro and micro viewpoints. The micro viewpoint related to the project construction phase, where the project goals like time, cost, performance, quality, safety were taken into consideration. While the macro viewpoint dealt with the users and stakeholders' satisfaction. Lim and Mohamed (1999) have highlighted the importance of completion and satisfaction criteria; however, they have failed to take into account the viewpoint of strategic goals of the contraction company.

Some researchers have merged the strategic impact of project within other dimensions of project success. For example, Baccarini (1999) has separated project success into two components, as shown in Fig. 3. The first one is project management success, which includes: the basic criteria; project management process; and stakeholders' satisfaction. The second component was product success, which comprised of owners' strategy; user's satisfaction; profitability and market share. However, he has not

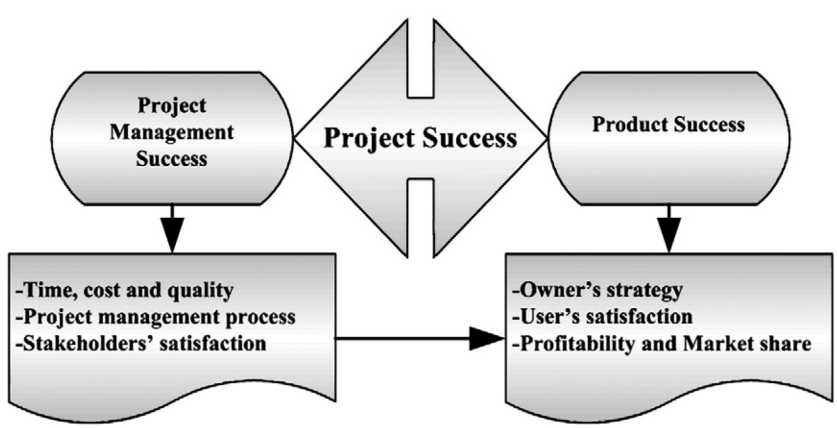

Fig. 3. Project success components. Based on Baccarini (1999), p. 28).

distinguished the strategic dimension of project success; he embodied it within product success.

Chan and Chan (2004) have proposed two groups of key performance indicators for construction project success. The first group was objective measures, which were the issues of time; cost; safety; and environment. The second group was subjective measures, which comprised quality; functionality; and satisfaction of different project participants. They have tied the performance indicators with success criteria, but those indicators were limited to operational and tactical levels and excluded the strategic level of the project. Similarly, Ahadzie et al. (2008) have 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 organisation.

Bryde and Robinson (2005) have compared the perspectives of the client and the construction contractor on project success criteria. In developing their study, they have used five sets of success criteria, which including: cost; time; meeting the technical specification; and customers' and stakeholders' satisfaction. Those criteria were drawn from a study by Tukel and Rom (2001). Even though, Tukel and Rom (2001), in their study, have addressed 17 types of projects belonging to various services or manufacturing industries. In other words, the study did not particularly aim at construction projects.

Blindenbach-Driessen (2006) has carried out a study to evaluate the performance of development projects. She has proposed an interesting model that consisted of two constructs, as shown in Fig. 4. The first one was project success, which related to the development process of new products and services. The second construct was market success, which covered the commercial outcome of a development project. The proposed model was comprehensive and she has contributed a significant knowledge; however she failed to distinguish between project success and project management success. As a matter of fact, the distinction between project success and project management success is important (Cooke-Davies, 2002). The importance of this distinction can be realized when the success of project management does not result in the success of the project if the expected benefits are not achieved (Wideman, 2009). Furthermore, if a project achieved project success without project management success, this indicated that the project management failure was of little significance in the longer term (Munns and Bjeirmi, 1996) and there was the inevitable conclusion that even greater benefits could be realized (Cooke-Davies, 2004). On the other hand, if project management success was achieved without project success; then the project failed because of other reasons, such as: it had not been used as was initially intended, could not be marketed, or did not get returns on the client investment (Munns and Bjeirmi, 1996). In other words, the owner or sponsor has failed to obtain the benefits that might be provided by the designed project (Cooke-Davies, 2004).

Several recent studies have been conducted to introduce various models for measuring the success of construction projects. For example, Frodell (2008) has drawn a list of construction success criteria through reviewing 16 articles. His empirical study has originated success measures such as, keeping within the budget; finishing on time; profitability; and maintenance costs and project goals. However, Frodell's study was limited to client's perspectives. Therefore, the contractors' perspective might lead to different measures, as project success means different things to different people (Chan and Chan, 2004; Freeman and Beale, 1992; Liu and Walker, 1998).

Takim and Adnan (2008) have attempted to judge construction project performance in terms of measures of effectiveness. Their study revealed five groups, which were represented by: learning and exploitation; client satisfaction; stakeholder objectives; operational assurance; and user satisfaction. As a matter of fact, it is significant for a construction project to achieve the project objectives and align the project outcomes with customer needs and expectations; however, these measures should be integrated with efficiency and strategic goals of the company.

Elattar (2009) has developed a hierarchical model framework for the construction project success. He has proposed three sets of success criteria that viewed three perspectives, which were

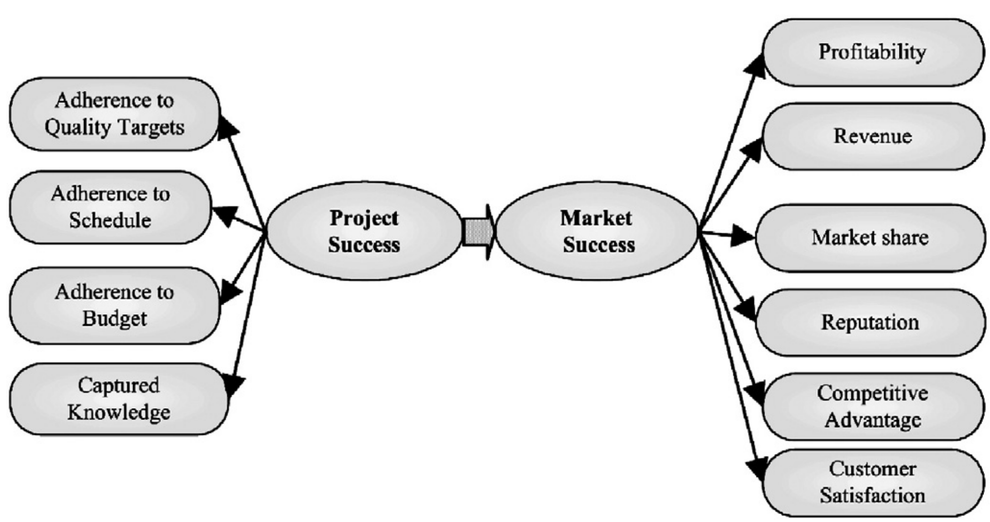

Fig. 4. Theoretical performance model. Source: Blindenbach-Driessen (2006, p. 60).

owner; designer; and contractor. The first set of criteria from the owner's perspective included: schedule, budget, function for intended use, end result as envisioned, quality, aesthetically pleasing, return on investment, marketability, and minimized aggravation. The second set comprised the designer's perspective and consisted of: satisfied client, quality architectural product, met design fee and profit goal, professional staff fulfillment, met project budget and schedule, marketable product/ process, minimal construction problems, no liability claims, socially accepted, client pays, and well defined scope of work. The third set consisted of the criteria from the perspective of the contractor. Those criteria were met the schedule, profit, under budget, quality specifications, no claims, expectations of all parties clearly defined, client satisfaction, good direct communication, and minimal or no surprises during the project. Elattar (2009) has addressed an important issue when he viewed different perspectives on the success concept; however, he failed to properly designate between success criteria and success factors. Some of the listed measures were more likely to be the success factors rather than the success criteria. For example, good direct communication; minimal or no surprises during the project; minimize aggravation in producing a building; and minimal construction problems.

Subsequently, success criteria models and frameworks, which are currently available, are not matched with the needs of the construction industry (particularly building projects) for new business strategies. Moreover, those models and frameworks have shortcomings of taking into full account all of the project's life cycle and align the project efforts with both short and long-term goals of the company. As a consequence, there is a great need for identifying the key success criteria that address the construction industry projects to be used by construction executives and project managers to plan their resource allocation appropriately (Cox et al., 2003). This paper attempts to bridge this gap by providing a framework that comprises of the success criteria of building projects that ensure an alignment with business success in the long-term.

4. Research methodology

In order to investigate the research question about the criteria needed for the success of a project from the perspective of contractors, a survey involving building contractors in Kuala Lumpur, Malaysia was used. The targeted respondents for this study were drawn randomly from the registered list of the CIDB (Construction Industry Development Board of Malaysia) under Class G6 (tendering capacity 10 million Ringgit Malaysia) and Class G7 (tendering capacity of more than 10 million Ringgit Malaysia). Kuala Lumpur was chosen as the city of comprising of the largest number of contractors of Classes G7 and G6, the percentage of registered contractors in this region is around 31.25% of the total of 15 states (CIDB, 2008). Postal and e-mails surveys were used. The e-mail survey can be quicker and more effective than postal surveys at reaching a wider audience (Adams and Brace, 2006). Moreover, personal delivery was made to increase the rate of response and thus the representation of the sample.

The questionnaire survey was conducted in 2006 (February–June), and consisted of close-ended questions with sufficient space provided for the respondents to give additional information to elicit the respondents' perceived importance of the 13 success criteria that are adopted for this study. These criteria included: Cost (C), Time (T), Quality (Q), Safety (S), Achieving Scope (AS), Customer Satisfaction (CS), Technical Specifications (TS), Functional Requirements (FR), Market Share (MR), Competitive Advantage (CA), Reputation (R), Revenue and Profits (RP), and Benefit to Stakeholder (BS).

Although close-ended questions are more difficult to design than open-ended questions, they come up with much more efficient data collection, processing and analysis (Bourque et al., 2003). Bourque et al. (2003, p. 64) said that "surveyors should avoid using open-ended questions (or use them only sparingly) in mail and other self-administered questionnaires". In creating the questionnaire, the researcher used English language to overcome any misinterpretation of used terms; moreover, the sentences used were simple and short to improve response rates (Dillman, 2000). In addition, definitions of project success measures were provided in the questionnaire to assist respondents in the understanding of the questions.

The questionnaires were sent to 660 Malaysian construction companies and they targeted staff working in building projects at the managerial level. Participants were invited to rate each criteria on a five-point Likert scale that required a ranking (1–5), where 1 represented "not important" and 5 represented "extremely important", as the case might be.

The reliability of the questionnaire was assessed using Cronbach's alpha coefficient. Then a factor analysis was conducted, using the Principal Component Analysis (PCA) in order to eliminate criteria that did not contribute significantly to the distinguished components of the study. Components were then rotated to assist in the process of interpretation and to discover the best distribution of the better loading components in terms of the meaning of the components. This does not change the underlying solution, or the relationships among the variables. Rather, it presents the pattern of loadings in a manner that is easier to interpret (Reinard, 2006). The Varimax's approach rotation was used, which is recommended as a good approach to improve and simplify the interpretability of components by maximizing the loading of each variable on one of the extracted components whilst minimizing its loading on all the other components (Field, 2000). Analysis of the data was undertaken using SPSS (Statistical Package for the Social Sciences) Version 17.0.

5. Data analysis and results

5.1. Response rate

A total of 151 questionnaires were satisfactorily completed, making the total response rate 22.8%, which is acceptable according to Akintoye (2000) and Dulaimi et al. (2003) who stated that the normal response rate in the construction industry for postal questionnaires is 20–30%. Stevens (1996) stated that the sample should comprise a variable and a number of observation ratio of at least 10 to 1 for exploratory factor analysis. Since the questionnaire consisted of 13 criteria versus 151 respondents, a ratio greater than 10 to 1 existed between the number of variables and the number of observations. Thus, this sample was adequate for factor analysis to be undertaken.

The General Respondent Demographics (GRD) of the respondents revealed that the majority of the respondents (94%) were holding a Bachelor's degree as shown in Table 1. The age of respondents ranged from 20 to 59 years old with the majority in the age groups 30–39 years (46.3%) and 40–49 years (44.4%). Regarding the respondents' occupation, Table 1 indicated that the majority of the respondents (67.5%) were involved in the management of projects (Senior Manager, General Manager, Contracts Manager, Construction Manager, Executive Manager, Project Manager). However, not all respondents worked at the managerial-level; more than half of them (53%) had an experience of 20–24 years.

5.2. Internal consistency reliability

Cronbach's alpha provides an accurate estimate of internal consistency and indicates how well the items in the set were correlated to one another (Brown, 2001). The internal consistency ranges between zero and one. A commonly-accepted rule of thumb was that scores of above 0.70 were considered acceptable (Nunnally and Bernstein, 1994). Cronbach's alpha was computed at 0.702, which indicated that the items were from a scale that had reasonable internal consistency reliability.

5.3. Factor analysis

Factor analysis refers to a statistical technique that summarizes the relationships between original variables in terms of smaller set of derived variables called factors or components (Hardy and Bryman, 2004). According to Jugdev and Muller (2005), it was advisable to reduce the variables and measure them well, rather than have a large number and not address them properly. This study adopted a Principal Component Analysis (PCA) to set up which criteria could capture the aspects of the same dimension of project success and examine the underlying structure or the structure of interrelationships among the thirteen criteria. Then, the components rotated were measured using the Varimax approach.

The sample was first assessed for its suitability to the factor analysis application. The Kaiser–Meyer–Olkin Sampling Adequacy Test and Bartlett's Test of Sphericity were carried out. The results of these tests are reported in Table 2. The Bartlett Test of Sphericity was 312.894 and the associated significance level was 0.000, indicated that the population correlation matrix was not an identity matrix (Larose, 2006), as shown in Table 3. Moreover, the value of the Kaiser–Meyer–Olkin (KMO) measure of sampling accuracy was 0.748, and was considered acceptable (Hair et al., 2005). The results of these tests showed that the sample data were appropriate for factor analysis.

Factor analysis was then carried out to examine the underlying structure or the structure of interrelationships among the variables. The eigenvalue criterion stated that each component explained at least one variable's worth of the variability, and therefore only components with eigenvalues greater than one should be retained (Larose, 2006). This analysis yielded four components initially extracted with eigenvalues exceeding 1, accounting for 53.663% of the total variance in the 13 criteria of project success (Table 4). The four components solution explained a sum of the variance with component 1 contributing 24.604%; component 2 contributing 11.549%; component 3 contributing 9.102% and component 4 contributing 8.407%. Table 5 shows the components matrix with cell entries called the components weights (loadings). These components' weights described the partial correlation between a particular variable and a given component.

For better interpretation of these four components, the Varimax Rotation was performed. The rotated solution revealed the presence of simple structures with a new pattern of loadings that is easier to interpret (Table 6). For clarity and interpretative purposes, the loading values were examined using Hair et al.'s (2005) guideline for practical significance. This guideline indicated that a component loading of ±0.3 meant the item was of minimal significance, ±0.4 indicated it was more important, and more than ±0.5 indicated that the component was significant. Larose (2006) has also claimed that communalities less than 0.5 were considered too low, since this would meant that the variable shares less than half of its variability with other variables. Therefore, variables with loadings less than 0.5 were suppressed

Table 1
General Respondent Demographics (G.R.D.) characteristics of the respondents.

G.R.D.	Groups	Frequency	Percent	Cumulative percent
Educational	Bachelor	142	94.0	94.0
	Master	9	6.0	100.0
	PhD	–	–	100.0
Age	20–29 yrs	11	7.3	7.3
	30–39 yrs	70	46.3	53.6
	40–49 yrs	67	44.4	98.0
	50–59 yrs	3	2.0	100.0
	60+ yrs	–	–	100.0
Occupation	QS	–	–	–
	Project (construction) engineer	13	8.6	8.6
	QA/QC	14	9.3	17.9
	Resident/site engineer	22	14.6	32.5
	Consultant	–	–	32.5
	Manager	102	67.5	100.0
	Director	–	–	100.0
Experience	5–9 yrs	9	5.9	5.9
	10–14 yrs	27	17.9	23.8
	15–19 yrs	35	23.2	47.0
	20–24 yrs	80	53.0	100.0
	25+ yrs	–	–	100.0

Table 2
KMO and Bartlett's test.

Kaiser–Meyer–Olkin measure of sampling adequacy		0.748
Bartlett's test of sphericity	Approximate chi-square	312.894
	df	78
	Sig.	0.000

Table 3
Correlation matrix.[a]

		S	FR	MR	BS	R	Q	AS	C	CA	T	RP	TS	CS
S	*r*	1												
	Sig. (1-tailed)													
FR	*r*	0.170 *	1											
	Sig. (1-tailed)	0.018												
MR	*r*	−0.055	0.083	1										
	Sig. (1-tailed)	0.252	0.156											
BS	*r*	0.252 **	0.134	−0.055	1									
	Sig. (1-tailed)	0.001	0.051	0.250										
R	*r*	0.229 **	0.106	0.136 *	0.205 **	1								
	Sig. (1-tailed)	0.002	0.097	0.047	0.006									
Q	*r*	0.386 **	0.190 **	0.117	0.277 **	0.246 **	1							
	Sig. (1-tailed)	0.000	0.010	0.077	0.000	0.001								
AS	*r*	0.221 **	0.225 **	0.038	0.295 **	0.084	0.368 **	1						
	Sig. (1-tailed)	0.003	0.003	0.320	0.000	0.152	0.000							
C	*r*	0.326 **	0.082	0.137 *	0.306 **	0.227 **	0.578 **	0.371 **	1					
	Sig. (1-tailed)	0.000	0.159	0.046	0.000	0.003	0.000	0.000						
CA	*r*	0.249 **	0.058	−0.052	0.245 **	0.212 **	0.197 **	0.302 **	0.131	1				
	Sig. (1-tailed)	0.001	0.238	0.264	0.001	0.004	0.008	0.000	0.054					
T	*r*	0.254 **	0.050	−0.007	−0.139	0.211 **	0.322 **	0.310 **	0.357 **	0.181 *	1			
	Sig. (1-tailed)	0.001	0.272	0.464	0.044	0.005	0.000	0.000	0.000	0.013				
RP	*r*	0.128	0.010	0.052	−0.067	0.109	0.029	−0.093	−0.056	0.221 **	0.162 *	1		
	Sig. (1-tailed)	0.059	0.452	0.265	0.206	0.092	0.363	0.127	0.248	0.003	0.023			
TS	*r*	0.169 *	0.237 **	0.056	0.301 **	0.177 *	0.271 **	0.220 **	0.276 **	0.052	0.138 *	0.051	1	
	Sig. (1-tailed)	0.019	0.002	0.248	0.000	0.015	0.000	0.003	0.000	0.265	0.045	0.266		
CS	*r*	0.026	0.182 *	−0.030	−0.120	0.087	0.370 *	−0.086	0.007	0.063	0.054	−0.097	0.168 *	1
	Sig. (1-tailed)	0.374	0.012	0.358	0.070	0.144	0.000	0.148	0.468	0.220	0.256	0.119	0.020	

r=Pearson correlation.
[a] Determinant=0.115.
* Correlation is significant at the 0.05 level (1-tailed).
** Correlation is significant at the 0.01 level (1-tailed).

and removed from the analysis due to a low communality. On the basis of these tests, three criteria were eliminated from the component pattern matrix, which were S; AS; and BS.

6. Discussion

From a look at the rotated four components solution shown in Table 6, it can be seen that each criterion strongly loaded on only one component and each component was represented by a number of strongly loading criteria. Three variables (criteria) are troublesome as they do not load well on either component. In other words, they do not share much variance with the other variables; thus, they are unlikely to be useful in defining a component. Note that, the first criterion S loaded close to 0.5 (0.491) on component 1; despite it being also cross-loaded on more than one component. The second criterion is AS, which described the processes concerned with ensuring that the project included all work required, and only the work required to complete

Table 4
Total variance explained.

Component	Initial eigenvalues			Extraction sums of squared loadings			Rotation sums of squared loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.198	24.604	24.604	3.198	24.604	24.604	2.727	20.974	20.974
2	1.501	11.549	36.153	1.501	11.549	36.153	1.520	11.696	32.670
3	1.183	9.102	45.255	1.183	9.102	45.255	1.488	11.446	44.115
4	1.093	8.407	53.663	1.093	8.407	53.663	1.241	9.548	53.663
5	0.956	7.356	61.019						
6	0.887	6.824	67.843						
7	0.809	6.225	74.068						
8	0.723	5.563	79.632						
9	0.680	5.234	84.865						
10	0.579	4.454	89.320						
11	0.546	4.198	93.518						
12	0.482	3.707	97.225						
13	0.361	2.775	100.000						

Extraction method: Principal Component Analysis.

Table 5
Component matrix.[a]

	Component			
	1	2	3	4
Q	0.735			
C	0.711			
AS	0.629			
BS	0.604			−0.335
S	0.591			
T	0.569		0.465	
TS	0.489	0.337		−0.316
CS		−0.516		0.475
R	0.418	−0.456		
CA	0.441	−0.442	−0.312	
RP		0.520	0.602	
FR		0.412	0.494	
MR		0.441		0.677

Extraction method: Principal Component Analysis.
[a] 4 components extracted.

the project successfully (PMBOK, 2004). Likewise, this criterion moderately associated with the first component (0.482), as well as it was loaded on more than one component. The third criterion was BS, which concerned the stakeholders. Stakeholders represent all organisations or individuals that had an interest in a project or will be affected by its deliverables or outputs (PMBOK, 2004). BS had low association (0.423) with component 1; besides it was loaded on three components. Therefore, these criteria (i.e. S, AS, and BS) should possibly be dropped from the analysis, because they do not fit well with the component solution and have little contributions to the model. This implies that there is overlap (or similarity) between these criteria and other criteria. For example, for any building project, it is seldom to successfully achieve project's targets, unless it is within project scope and insure an efficient safety system.

In such a manner, the result of the factor analysis suggested four components. These components explained (56.663%) of total variance. Although the total variance explained by the proposed components structure is not high, this is consistent with Meyers et al. (2006), who have suggested that the component solution should explain at least 50% of the total variance.

SPSS does not label or interpret each component; it only indicated which variables clumped together. Thus, according to our understanding of the content of the variables, possible interpretations can be proposed (Pallant, 2007). Fig. 5 illustrates the proposed designation for the components. The next section will interpret and discuss each of these components.

Table 6
Rotated component matrix.[a]

	Component			
	1	2	3	4
C	0.777			
Q	0.735			
T	0.701			
S	0.491		0.372	
AS	0.482	0.307	0.346	
BS	0.423	0.414		−0.307
CS		0.708		
TS	0.333	0.583		
FR		0.563		0.359
RP			0.801	
CA			0.630	
MR				0.775
R	0.433			0.540

Extraction method: Principal Component Analysis.
Rotation method: varimax with Kaiser normalization.
[a] Rotation converged in 5 iterations.

6.1. Component 1: project management success (PMS)

In component 1, there were three criteria which were strongly associated with this component, Q (73.5%); C (77.7%); and T (70.1%), as shown in Table 6. This cluster accounted for 26.604% of the total variance (Table 4). Under this component, the correlations between the three variables can be distinguished by project management performance, and to which extent the project was executed in accordance with the plan. Therefore, these criteria were placed by the researchers into the Project Management Success (PMS).

The correlation matrix showed that there was a statistically significant correlation among the three criteria within this dimension of project success. The association between C and Q was (r=0.578, p=0.000), as well as a strong negative association between C and T (r=− 0.357, p=0.000), as shown in Table 3. These associations were logical as these parameters are all fundamentally measures of the success of the project management.

This dimension measures the efficiency of project execution and ensures that the project is done right. The findings strengthened the viewpoint presented in the previous researches (for example, Pheng and Chuan, 2006; Jaselskis and Ashley, 1991) which assert that this dimension (PMS) is very important for project success. Similarly, Pheng and Chuan (2006) have claimed that the success of a project depends on the performance of project managers. In the same context, Jaselskis and Ashley (1991) have considered the project management as a tool to maximize the success of a project.

Generally, project managers are responsible for balancing of the project performance targets and achieving the completion of each particular project within predefined time, cost and quality constraints. Definitely, this task is not easy in building construction. Mota et al. (2009) have directed the difficulty of this task to the complexity, uncertainties, and large number of activities involved. Thus, general knowledge and skills are essential for a project manager to be successful in managing project. For example, the project manager needs to be a reactive problem-solver; flexible to deal with uncertainties in the project environment; and creative to lead and motivate people.

However, there is a general agreement that C; T; and Q are important components of the overall construct (Prabhakar, 2008), achieving these triple targets is not sufficient and cannot guarantee for the success of a project in the light of a highly competitive environment. Furthermore, the importance of this dimension the importance of this dimension starts to decline after the project is completed (Shenhar et al., 2001). Thus, assessing project success would relate to other aspects. For example, the client and end-user

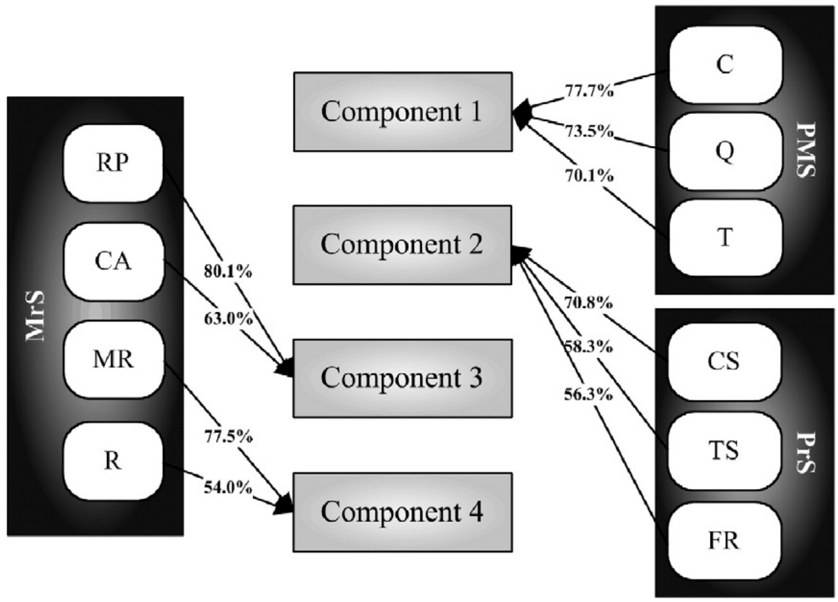

Fig. 5. Loadings of success criteria on components.

perspectives of the whole project, as well as to what extent this project will strengthen the strategic situation of the company. This nominates the second and third dimensions of project success.

6.2. Component 2: product success (PrS)

This cluster explained 11.549% of the total variance (Table 4). Component 2 was represented by three strongly loading variables CS (70.8%); TS (58.3%); and FR (56.3%), as shown in Table 6. The correlations between the three variables can be distinguished by the impact of the project on the end-user or clients. Hence, component 2 was proposed to form the product success (PrS). It was not surprising that CS was the most significant item under this component, where the satisfaction of customers was well-known as an important factor in the development of the construction process and the customer relationship (Karna et al., 2009).

The findings showed that there was a statistically significant correlation among the three criteria within the product success dimension. The correlation matrix (Table 3) revealed significant association between the CS and TS ($r=0.168$, $p=0.02$). TS is a list of instruction and requirements that construe with construction drawings (Choi, 2004). The importance of the TS reflected the effect of the clarification of any ambiguities of these specifications on the customer (particularly the owner). As mentioned by Jackson (1990), clarification of ambiguities of TS leads to reduce disputes and thus lessen overhead costs for both owners and contractors.

In a like manner, the correlation between CS and FR was significant ($r=0.182$, $p=0.012$). As FRs refer to the actions that a project must be able to perform (Bittner and Spence, 2003), the significant association is reasonable. Indeed, there would be no point in undertaking a project if it does not fulfill its intended function (Kometa et al., 1995). This confirmed that customers like the building to be suitable for their own lifestyle. Furthermore, this result was consistent with McGoverna and Hicks (2006), when they claimed that the FRs were based on identifying customer requirements. Consequently, to increase customers' satisfaction and successfully implement a project, all technical and functional requirements must be fulfilled.

On the other hand, no significant correlation was found between the CS and the C ($r=0.007$, $p=0.468$), as well as the CS and the T ($r=0.054$, $p=0.256$) as shown in Table 3. While, the correlation matrix revealed significant association between the CS and the Q ($r=0.307$, $p=0.000$). These results capture the effects of quality, rather than cost and time, on satisfaction of the customers. This implies that the major concern of customers is the quality of projects. In support of these results, Karna et al. (2004) has claimed that customers want their needs and expectations met or exceeded. Furthermore, Hendrickson and Au (2008) have suggested that the increase in construction costs can be justified, if profits derived from earlier facility operation. They have elaborated that the project is considered a success even if construction costs far exceed the budget, if the owner can derive reasonable profits from the completed facility. It is therefore a building company must be aware of the level of its customers' expectations, and try to exceed that level to perceive itself as superior (Tukel and Rom, 2001).

6.3. Components 3 and 4: market success (MrS)

Component 3 was assessed through two criteria: RP (80.1%) and CA (63.0%), as shown in Table 6, and accounted for 9.102% of the total variance (Table 4). Similarly component 4 comprised of two criteria, which are MR (77.5%) and R (54.0%), and explained 8.407% of the total variance. These two clusters (component 3 and component 4) accounted for 17.509% of the total variance.

The correlations between the variables under both the components (i.e. components 3 and 4) referred to the success of the end result in the long term of the project's life cycle. Thus, it was appropriate to name those two components as market success (MrS). It is well known that understanding and evaluating projects from the commercial viewpoint is very important for building companies, as projects connected with companies' businesses.

The strong association between RP and CA (r=0.221, p=0.003) implied that the higher profits sustained enhanced a competitive advantage (Table 3). This finding supported by Freeman's argument that revenue and the levels of profits could help contractors to gain a competitive advantage (Freeman, 2001). Given the presence of a lot building contractors, the Malaysian construction industry might be considered as a highly competitive industry. In addition, the increasing complexity of markets due to the acceleration of the global economy, made it difficult for building companies to compete effectively in markets. Hence, companies could compete either by lowering price or by doing something different from the other organisations in the sector (Freeman, 2001). Therefore, building contractors can gain a competitive advantage either by lowering the markup to the project cost when submitting the bid price, or by developing new strategic approaches and technologies and respond to current and future customer needs to deliver successful projects. However, the construction industry has been criticized for its slow adoption of emerging technologies (Yang et al., 2007).

It was clear from the results of the correlation matrix (Table 3) that the correlation between MR and R is significant (r=0.136, p=0.047). This result is expected, as building up a strong reputation would help a company to gain market share, and vice versa. Both criteria (R and MR) are influential in the building project success. MR is one of the important indicators of a company's success. It has been associated the increased of MR with success, and a decreased MR with the failure of the company (O'Regan, 2002). Correspondingly, the company's reputation can be impressiveness measure of project success to contractors (Takim and Adnan, 2008). In fact, the loss of reputation reflects the customer's attitude toward a company rather than toward an individual project (Harrington, 1999). Therefore, it is important for the building company to sustain the pillars of its reputation by reflecting a good impression to the clients and delivering value to its customers.

As a matter of fact, this dimension concerns of the project executives more than project managers. This assumption is based on Shenhar's et al. (2001) argument. They have indicated that project managers and executives are working according to a different timescale. As the managers leave the project after completion and delivery; while the executive is faced with the long-term results of this project.

In summary, the results distinguished three dimensions of project success, which are PMS; PrS and MrS as described in Fig. 6. The proposed framework incorporates the success dimensions, which considered the project's execution period and customer's perspective, as well as the impact of project on the company's business in long term.

7. Conclusion

It will be incompetent to judge a project's success merely according to the objective criteria (i.e. cost, time, and quality). From that reason, it is imperative for building contractors to plan for the future, which often will include development of strategies and technologies that respond to current and future customer

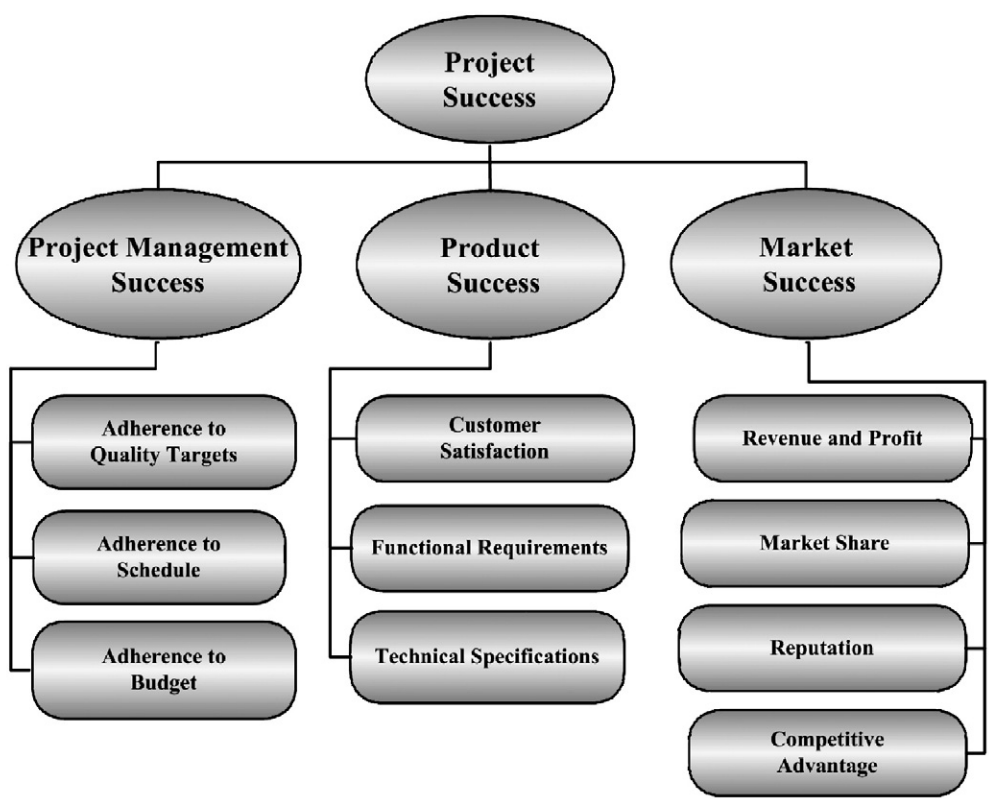

Fig. 6. Success criteria for building projects.

needs. This research reports the statistical results of a survey aimed at collecting perceptions of contractors about the success criteria in the construction of buildings and extracting the significant criteria related to the success of building projects. The findings of this research showed that project success is a multi-dimensional concept, in line with previous findings (Atkinson, 1999; Shenhar and Wideman, 1996). Conceptually, the building project is most successful when it is capable in integrating the three success dimensions. The first one is PMS, which concerns with achieving management targets in terms of completing within the contracted period and allotted budget as well as conformance to the requirements. The second dimension is PrS that relate to the end product's (building's) targets in terms of functionality and fulfilling the technical requirements, as well as customer satisfaction. While the third dimension is MrS, which relates to the project's potential in contributing to company's success in long term in terms of gaining a competitive advantages; enhancing company's reputation; increasing the market share; and reaching specified revenue and profits.

The proposed framework will provide an essential and appropriate judgment for measuring project success in the short-term context of the project development as well as the long-term financial objectives of the company. This will clarify the managers' thoughts and enhance their knowledge about project success, and support the development of measuring performance of building projects as well.

Thus, it is hoped that the framework provided in this paper will help to assist the management to understand the key elements of success, to maximize the probability of a successful project outcome, to plan for the future and gain a competitive advantage. In addition, this framework will provide some basis for further research in this vital area.

For further studies, it would be interesting to look deeper into the proposed success criteria and rank those criteria according to project objectives. This will help to develop an appropriate decision making system that will enable contractors and managers to make better decisions lead to successful building projects.

One of the limitations of this study was the low variance explained by the proposed components structure, which has caused a large amount of unexplained variance. The reason for this might be due to the differences in the demographics of the respondents. Thus, the framework needs to be tested and proved with other samples to increase its descriptive power and external validity. Another limitation of this research is that it is confined to only the building projects. However, the findings from this study could be considered as a guide to assess and develop success criteria for other industries.

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