DEFINING CONSTRUCTION PROJECT MANAGEMENT CRITICAL SUCCESS FACTORS USING THE BUSINESS EXCELLENCE MODEL

Sambo Zulu[s1] and Andrew Brown[b]

[a]School of the Built Environment, Leeds Metropolitan University, Leeds, LS1 3HE, UK, Tel: +44 (0)1138127644, Fax:+44(0)113 8121958, Email: s.zulu@leedsmet.ac.uk

[b]School of the Built Environment, Heriot Watt University, Edinburgh, EH14 4AS

[1] s.zulu@leedsmet.ac.uk

DEFINING CONSTRUCTION PROJECT MANAGEMENT CRITICAL SUCCESS FACTORS USING THE BUSINESS EXCELLENCE MODEL

Abstract

The paper reports of an evaluation of a project management measurement framework that was used to cluster construction project management critical success factors. A review of literature suggests that there is a lack of agreement on what considered as critical success factors for construction project management. This in part is due to a lack of a common framework for the definition of critical success factors. The paper acknowledges the need to have a common basis for the definition of project management critical success factors and argues that the business excellence model provides a sound framework for this. A project management critical success factors (CSF) model was developed based on the business excellence model which to some extent can be looked at as a causal model between the management processes and the business or organisational results.

The business excellence model was used to define constructs to which various critical success factors as identified in literature were mapped against. Data was collected using a questionnaire survey concerning various critical success factors. Results of a statistical analysis confirm that the project management CSF model is reliable and that the constructs used can be used to cluster construction project management critical success factors. Further examination of the data regarding the relative importance of the critical success factors is consistent with many other studies on critical success factors.

The research concludes that the measurement model for construction project management critical success factors, as presented in the paper is a reliable scale and that such a model present a sound framework for the definition of factors critical to project management performance.

Introduction

The investigation of project and project management critical success factors has been an area of interest to many researchers. This in part is due to the rate of failure of projects, especially in the construction industry, in meeting the targets for time, cost and quality. However it is generally agreed that the purpose of project

management on a construction project is to deliver successful projects in terms of agreed project objectives (The Construction Industry Council (2007). There have been a number of studies that have been undertaken to examine factors that are critical to the successful performance of projects. Critical success factors can be defined as 'the areas in which good performance is necessary to ensure attainment of organisational [project/project management] goals' (Rockart 1979 as cited in Fortune & White 2006; 53). Munns and Bjeirmi (1996) differentiated between project management success and project success. They defined project management success in terms of short-term goals such as the completion of the project on time, within budget and to the required quality while project success was measured in terms of long term including such issues as profitability, competition and marketability. They suggested, therefore that the control of time, cost and progress, which are the objectives of project management, should not be confused with measuring project success. This paper is concerned with project management success on construction projects. An examination of literature on project management critical success factors suggests that there is no consensus amongst researchers of the list of these critical success factors. For example, Fortune and White (2006) reviewed sixty three publications and found that there is a limited agreement in the studies on the critical success factors. Iyer and Jha (2005), also in reviewing thirteen publications found no consensus among different researchers on the critical success factors. Similarly Chan & Chan (2004), Ahadzie et al (2008) and Toor & Ognunlana (2008) all acknowledged that there is no agreement among researchers as to what should be considered as a definitive list of critical success factors on construction projects.

One of the reasons for this lack of clarity in the list of critical success factors is the lack of an agreed framework for the definition of the factors. A survey of project management literature also shows that there is no agreed defined theoretical framework to analyse project management critical success factors (Zulu 2007). Westerveld (2003) suggest that studies in critical success factors have lacked a theoretical framework to define the linkages between success factors and performance. Morris (2000) also argued for the need for a sound theoretical basis on the evaluation of the influence of project management on successful project delivery. He stated that there is need for project management research to be underpinned by a sound theoretical framework, which would demonstrate how the project management discipline works to influence projects successfully. Fortune and White (2006) also acknowledged that most critical success factors literature does not account for the interrelationships between the critical success factors and how this would have an impact on project performance. They also acknowledge that the factor approach taken in most studies tend to view implementation as a static process instead of a dynamic processes and therefore ignores the potential of varying degrees of importance critical success factors at different stages of the project lifecycle.

This paper contributes to the understanding of the impact of project management processes on project performance and addresses the need for a sound framework for the definition of critical success factors by using the well known European Foundation for Quality Management (EFQM) business excellence model. A project management CSF model, based on the causal structure of the business excellence model is proposed. This approach has been used before in Bryde (2003) and Westerveld (2003). However this paper extends the discussion and includes a discussion on the reliability of the measurement scales used, the relative importance of these factors and specifically addresses construction project management. The authors presented some of their preliminary findings in Zulu & Brown (2003, 2004 & 2007). This paper provides an extended discussion of the theoretical basis of the model used to cluster critical success factors and presents the project management CSF model. The results concerning the reliability of the measurement scales used are also presented. The paper is based on the authors' work that examined the impact of project management processes on project performance. The primary aim of the whole project was to examine the direct and indirect influences of critical success factors on project performance. In order to do this there was need for a framework that could be used to define the causal linkages between various project management critical success factors and project performance. The work used the business excellence model as the basis for the definition of the causal inter-linkages between the critical success factors and with construction project performance. The work used a two step process. The first step involved the testing of the reliability of the measurement scale and the second step involved testing the significance of the causal linkages in the model. This paper is only concerned with the first part, i.e. the assessment of the reliability of the measurement scale. The measurement scale represents the relationship between various constructs and their related indicator variables. Critical success factors identified in various literature sources were used as indicator variables.

Critical Success Factors

As stated above, several studies have investigated factors that are critical to the success of projects. For example Pinto and Slevin (1987 & 1988) in understanding factors that impact on project performance, designed a project implementation profile. Other studies include Larson and Gobelli (1989), Pocock and Kim (1997), Klien and Anderson (1996), Baker et al (1983), Chan and Chan (2004), Cooke-Davies (2002), Fortune and White (2008), Iyer and Jha (2006) and many others. Cooke-Davies (2002) argued that the understanding of these success factors should be understood from three different perspectives including factors critical to project management success, factors critical to success of individual projects and factors leading to consistently successful projects. For a

detailed list of literature on critical success factors, readers are referred to the work of Fortune & White (2006) and Iyer & Jha (2005).

A close examination of critical success factors literature reveals different perspectives have been used in understanding the influencing factors. Pockock and Kim (1997) for example examined the influence of the degree of interaction among project participants on project performance. Larson and Gobelli (1989) on the other hand examined the significance of project management structures on project success. They identified five types of project management structures which include functional organisation, functional matrix organisation, balanced matrix organisation, project matrix organisation and project team oriented organisations. Pinto and Mantel (1990) were concerned with patterns of causes of project failure depending on three contingent variables. They developed a project implementation profile model, a set of ten factors which where found to be generic to a wide variety of project type and organisations, to identify factors contributing to project success. They found out that the project implementation critical factors used in the study accounted only for about 40% of the variance in causes of project failure.

Yeo (2002) identified critical failure factors for information systems projects. They identified issues of influence under three main headings including, process driven factors, context driven issues and content driven issues. Under process driven issues they identified business planning, project planning and project management and control while under context driven issues they identified corporate culture, corporate management, users and politics. IT, business processes and system design, and IT/IS professional and knowledge were factors identified under the content driven issues. Under these factors they further identified critical failure factors.

Chan *et al* (2001) identified thirty one success factors for Design and Build projects which they grouped into six categories including, project team commitment, contractors competencies, risk and reliability assessment, clients competencies, end user's needs and constraints imposed by end user. Kog *et al* (1999) also identifies 27 project management factors that would influence schedule performance and grouped them into four categories including, project manager factors, project team factors, planning related factors and project controls factors. Belout and Gauvreau (2004) were concerned with the impact of human resources management on project performance. Jha and Iyer (2006) were concerned with critical coordination activities that have an influence on project success.

Pheng and Chua (2006) were concerned with environmental factors that affect project managers performance measured against time, cost, quality and customer satisfaction. They found out that nearly all variables were found to significantly affect project performance except for working hours and company size.

Team-relationships were ranked as the most important variable affecting project performance. Fortune and White (2006) in developing a systems model for critical success factors for IS projects, mapped success factors identified in literature onto their conceptual model. In developing the model they were concerned with the criticism with most of the work on critical success factors as discussed above. In response they developed a system model that captures critical success factors as identified in various literature on critical success factors and presented these factors interlinked with each other. Further they argue that because they take a systems approach and that the model has to respond to the environment, the model can be viewed as able to cope with the dynamic nature of projects. Olander and Landin (2005) were concerned with the influence of stakeholders in the implementation of construction projects. Based on case studies they showed how stakeholders could affect the construction projects, which may result in time and cost overruns. Dvir (2005) was concerned with effect of planning and preparation for commissioning on project success, while Gray (2001) was concerned with the association between project success and organisation climate measured by social and organisational climate.

Gowan and Mathieu (2005) were concerned with management practices in Information Systems projects that impact on project performance measured against target date. Using structural equation modelling they analysed the significance and strength of the direct and indirect relationships between the variables identified and project performance. Their findings were that technical complexity and project size did not directly affect meeting the project's target date, but rather it was the interaction of formal project management methodology that predicted the success of the project in terms of the target date.

It is evident from the literature review above that there is no consensus as to the list of factors and the method of grouping the factors that are critical to project success, The discussion in this paper contributes to this debate and uses the EFQM business excellence model, a quality management model, to understand the importance of these project management factors. The advantage of using the model is that it provides a sound basis for the clustering of factors that would influence the success of the project and the justification for the linkages between critical success factors and project performance. The International project management Association (IPMA) has also developed a project excellence model. However the items included under the various constructs were not intended to group or cluster project management critical success factors as identified in literature (Zulu 2007).

Westerveld (2003) and Bryde (2003) used similar approaches in analysing the impact of project management factors on project performance. They all developed models based upon the business excellence model. Westerveld (2003) developed a project management excellence model that shows the linkage between critical success factors and project management performance based on a case study. However Westerveld (2003) although aligned critical

success factors with the project excellence constructs did not report the reliability of scales used for each of the constructs. In addition Westerveld's (2003) work was not based on construction project management. The authors are of the view that it is important to test the validity of the scale, in light of the fact that project management in construction is seen as somewhat different from other industries. The introduction of separate project management guide and body of knowledge for the construction project management by the British Standard Institute (2007) and the Project Management institute (2007) respectively, shows the need to clarify the application of generic project management issues to the construction industry. Similarly, Bryde (2003) developed an evaluation model for project management. Bryde (2003) used a questionnaire survey to test the application of the model. However no participants from the construction industry were involved in the survey. In addition Bryde's (2003) work did not report of the reliability of the measurement scale used in the survey. Qureshi et al (2008) assessed the significance of Bryde's (2003) model. However similar to Bryde's (2003) work, they were not concerned with the construction industry. In addition their work was not an attempt to define critical success factors with the specific framework. Although this paper is similar to the approach taken in the two studies, it extends the discussion and provides evidence of the reliability of the measurement items with respect to construction project management. The paper further considers the relative importance of these items based on empirical data, an issue which was not considered in the other two studies.

The Model

As discussed above the conceptual project management CSF model for the clustering of project management factors was based on the business excellence model. The business excellence model as presented in figure 1 has two components, the enablers and the results areas. 'Enablers' represent the organisations activities while 'Results' represent what outcomes are achieved. The model is based on the premise that excellent results with respect to performance, customer, people and society, are achieved through leadership driving policy and strategy that is delivered through people, partnerships and resources and processes (Dijkstra (1997). The structure shows that leadership drive policy and strategy, people management and resources, which in turn drive processes. The enablers in turn determine people satisfaction, customer satisfaction and impact on society, which delivers business results. Dijkstra (1997) although arguing that the model cannot be conceived as a detailed specific empirical model, asserts that the framework can be interpreted as at least partly a causal model.

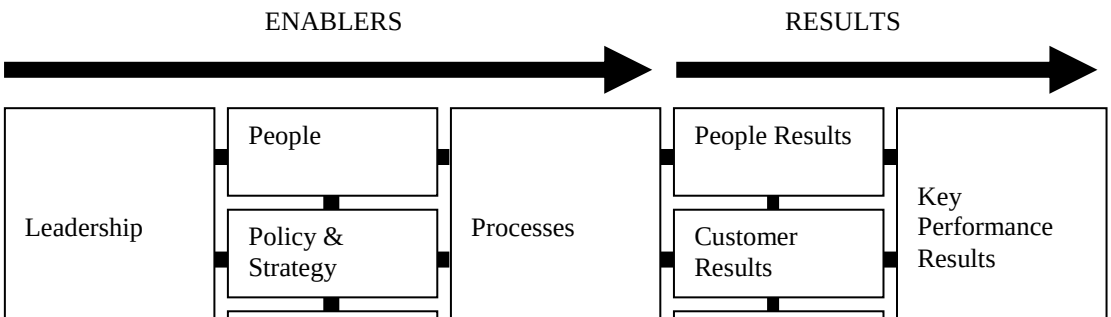

Figure 1: The EFQM Model (Copyright 1998-2003 © EFQM)

Similar to Westerveld (2003) and Bryde (2003) the authors argue that the model can be used to represent the causal relationships between construction project management critical success factors and project performance. Such a model would show both the direct and indirect relationships between critical success factors and project performance. This has been one of the criticisms of critical success factors literature (Fortune and White 2006). The proposed model uses the constructs in the business excellence model against which the critical success factors are aligned to. To make it relevant for construction project management analysis, the business excellence model's theoretical constructs were substituted with those relevant for project management. Since constructs are latent variables and cannot be measured directly, there is a need to operationally define the latent variables in terms of observed or indicator variables. For this research the critical success factors are used as indicator variables of the constructs. This relationship between the constructs and the indicator variables formed the measurement model (Byrne 2004).

Figure 2 depicts the conceptual project management CSF model based on the business excellence criteria. The model replaces leadership, people, policy and strategy, and processes with project leadership, project team, project management strategy and project management processes. However the partnership and resources constructs has been replaced with project communication. The authors acknowledge that partnerships involve management of stakeholders and that one of the main resources on a project is information. Cleland (1995) argued that one of the project manager's concerns is the identification, development and communication of a vision for the project stakeholders, who the leader wishes to lead. Pinto and Mantel (1990) also identified communication as the provision of an appropriate network and necessary data to all key actors in the project implementation. The results area are represented by one construct, project results. It should be noted here that the business excellence model has only been used to define the main project management critical success factors constructs. It is these constructs to which the different project management critical success factors identified in literature were mapped against as indicator variables. In effect the model postulates that construction project performance is a result of

project leadership driving the project team, project management strategy, project communication through project management processes.

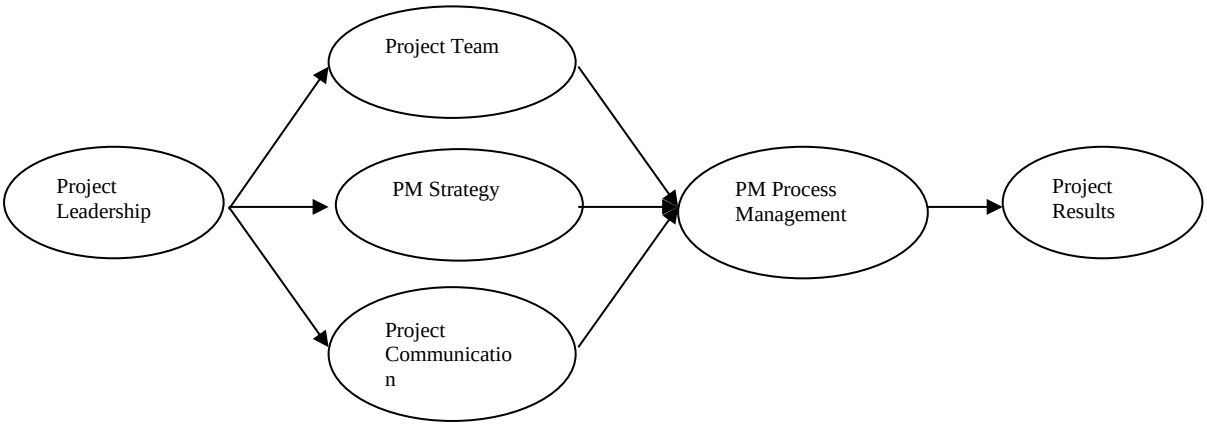

Figure 2: The Project Management Model (Adapted from business excellence model EFQM 2008)

Identification of Critical Success Factors

A review of literature was conducted to identify project management critical success factors. Once these were identified, they were then aligned with the different project management constructs. The clustering of the project management critical success factors was based on content proximity of the different critical success factors to relevant constructs. A total of thirty one factors were identified in the model and aligned with the constructs based on their content. Of these five factors were identified to be related to project leadership, seven to project team, six to project communication, six to project management processes and seven to project management strategy. It is important however to state that the list is not exhaustive. However it includes many of the factors in Fortune and White (2006) who identified critical success factors based on a review of 63 publications. A detailed discussion of literature for the development of measurement model for critical success factors was reported in Zulu (2007a and Zulu 2007b). The list in table 1 is a refined version of the variables' list as presented in Zulu (2007a and Zulu 200b). Below is a summary of a review of literature which was used to identify the factors included in the study.

There are a number of factors that can be used to measure the project management leadership construct. One of the critical functions in project leadership is concerned with designing organisation structures. Project managers are concerned with the conceptualisation and designation of the projects organisation structure to align the people and the resources to facilitate the accomplishment of the vision Cleland (1995). One of the factors

related to top management support is the level of authority given to the project manager. Turner and Müller (2003) argue that the project manager needs appropriate levels of authority entrusted by the client.

Top management support in literature is considered to be an essential requirement for successful projects (Cook-Davies and Arzmanow 2003, Cash and Fox 1992, Kerzner 2001 and Munns and Bjeirmi 1996 and Nicholas 1989 and Bryde 2008). In project management it is recognised as a factor that would affect project management performance. Cooke-Davies and Armani (2003) identified organisational leadership including commitment of upper management as measures of project management maturity. Cooke-Davies (2002) in defining factors that affect project management success included adequacy of documentation of organisational responsibility on the project as a variable. Project management methodology, definition of project success/failure criteria, project management process performance reviews, formal feedback mechanism, project manager's involvement in the project brief process, awareness of the project's requirements by all parties and quality and detail of project management plan/strategy were identified as suitable indicators of the project management strategy construct. Turner and Müller (2003) pointed out that the Project Manager, as chief executive of a project is responsible for formulation of objectives and strategy for the project and through the purpose of the project, to link those objectives and strategy to the objectives and strategy of the parent organisation. Anderson and Merna (2003) argued that poor management, particularly at the front end during strategy formulation rather than poor management down stream is the cause of poor project performance. However, most project management literature concentrates on the execution tools and techniques rather than the effective development and deployment of project management strategy within a total process concept. Anderson and Merna (2003) differentiated between project management strategy which refers to the strategy for the management of a project and project strategy which refers to the high-level plan for achieving a given projects objective.

Table 1: Measurement Model for Construction Project Management Critical Success Factors

Construct	**Item**
Project leadership	Clarity of Roles and responsibilities of the Project Manager
	Clearly defined of project goals
	Level of authority given to Project Manager
	Suitability of organisation structure
	Project manager's leadership style
Project management strategy	Project management methodology

	Clear definition of success criteria
	Project reviews
	Feedback mechanism
	Project Managers involvement in briefing
	Awareness of project requirements
	Quality of plan/strategy
Project Communication	Communication procedures
	Adequacy of information
	Timelines of communication
	Methods of communication
	Frequency of communication
	Accuracy of information
Project team	Roles and responsibilities of project team
	Team skills and knowledge
	Corporation between team members
	Commitment of team members
	Shared clear vision of goals
	Capability of team
	Working relationship in team
Project management process	Risk management
	Degree of monitoring and control
	Implementation of project management processes and procedures
	Change management
	Tools and techniques
	Frequency of feedback to client

The project team construct largely represents the human resource function in project management. There has been debate about the influence of the human resource function in project management. Belout and Gauvreau (2004) for example found out that the personnel factor had only a marginal effect on project success. This is a similar finding to Pinto and Prescot (1996). However literature on critical success factors includes functions related to the project team that are critical to the success of projects. Chan *et al* (1999) identified some measures of inter-organisational teamwork which included, the need for a shared and clear understanding of the functional and technical performance required by all participants, all project participants understood fully their roles and duties in the project, all project participants accepted the changes of their roles and duties in the project, all project participants shared common project goals, all project participants cooperated fully, a high degree of trust was shared by all project participants and project participants resolved conflicts quickly. Thamhain (2004) recommended some measures for effective team management which include among others the need to build and maintain commitment and management of conflicts and problems. Nicholas (1989) on the other hand included committed to project and project management process, teamwork, clear responsibilities/defined roles and

delegated authority and responsibility as indicators of good teamwork. It is evident from the above discussion that there is a plethora of factors that can be used as indicator variables for the project team construct.

The project communication construct focuses on communication within the project. Several studies have alluded to the impact of communication on project performance. Critical success factors included in the model include, frequency and method of communication (Müller (2003), and accuracy, procedures, timeliness and adequacy of communication (Thomas *et al* 1998). Variables identified as being suitable indicators of the project management processes construct include frequency of control meetings, frequency of feedback to client, risk management, implementation of project management methodology, project monitoring and control, change management process, project management tools and techniques, progress reporting, project planning, appropriateness and implementation of management processes and procedures and monitoring and feedback. The issues above are based on the work of Dvir *et al* (2003), Kog *et al* (1999), Kuprenas (2003), Fox (1992) and Munns and Bjeirmi (1996).

Methodology

Data Collection

This study uses the same approach as in many empirical studies on project success. Many empirical studies on project success have been based on empirical data using surveys and case studies (Fortune & White 2006). Data was collected using a questionnaire survey. The questionnaire included questions about the perception of respondents concerning various project management critical success factors identified in literature and as presented in table 1.The target sample was project management firms. The sample population was drawn from construction project management consulting firms in the UK. Targeted firms were drawn from dedicated project management firms, architectural consulting firm, engineering consulting firms and quantity surveying firms providing project management services. The criterion for selection was based on the firm's description of its services. Companies in the construction industry that listed project management as one of their main services were selected. It was hoped that by expanding the definition of project management firms, the number of possible respondents would increase therefore increasing the sample population to achieve a satisfactory sample size.

A total of 400 potential respondents were identified. A total of 67 completed questionnaires were received back representing a 17% response rate. This is within the expected response rate in questionnaire surveys (Burns 2000 and Denscomb 2003) and consistent with studies of project success (Bryde 2008). Of these, four questionnaires were rendered unusable because they were largely incomplete or the answers were deemed to be

inconsistent with the perceived pattern of answering. The remaining 63 (16%) were used in the subsequent analysis.

Analysis of Findings

The analysis of the data in this paper concerns two aspects. Firstly the analysis is concerned with the test of the reliability of the measurement scale. Although the factors used in the model have been used before, as identified in literature on critical success factors, and therefore assumed to be reliable indicators of critical success factors, it was deemed useful in this paper to analyse the reliability of the items with respect to their representation of the various project management CSF constructs. This was necessary as the construction project management model presented here represents a different methodology for the clustering of project management critical success factors. Secondly, having analysed the reliability of the model, the relative importance of the critical success factors was analysed. The relative importance of the factors was analysed across the constructs, to determine which group of factors is viewed as having more significance in influencing project results.

The analysis of the reliability of the measurement scale was based on factor analysis. This measures the internal consistency of the measurement model. Table 2- table 7 presents the results of reliability analysis. Both the Cronbach alpha values and inter-item correlations were considered. Cronbach alpha values of > 0.70 were considered to represent an acceptable measurement model for each particular construct (Pallant 2001). Pallant (2001) recommend optimal values of 0.2 to 0.4 for inter item correlation. The results from the analysis showed that the model's measurement scales have generally good internal consistency based on the Cronbach alpha values. Further examination of the inter-item correlations, for all the constructs, showed acceptable values as variables had values above the optimal values. Based on this data therefore it can be stated that the measurement scale used is reliable and that the constructs based on the business excellence model can be used to cluster construction project management critical success factors. The findings confirm that the model as a whole is plausible as a representation of the critical success factors under each construct for construction project management. As the model presented in figure 2 can be looked as a causal model, the model, including the measurement scale, can be used to test the structural validity of the direct & indirect causal influences of the critical success factors on project performance.

Table 2: Project Management Critical Success factors

Construct	Item	Mean	SD	Cronbach's alpha
Project leadership	Clarity of Roles and responsibilities of the Project Manager	5.25	1.244	0.752

	Clearly defined of project goals	5.02	1.338	
	Level of authority given to Project Manager	5.21	1.233	
	Suitability of organisation structure	5.17	1.251	
	Project manager's leadership style	5.70	.944	
Project management strategy	Project management methodology	4.63	1.495	0.900
	Clear definition of success criteria	4.63	1.473	
	Project reviews	4.43	1.653	
	Feedback mechanism	4.48	1.731	
	Project managers involvement in briefing	4.87	1.591	
	Awareness of project requirements	5.44	1.188	
	Quality of plan/strategy	4.98	1.198	
Project Communication	Communication procedures	5.35	1.152	.866
	Adequacy of information	5.10	1.174	
	Timelines of communication	5.10	1.187	
	Methods of communication	5.03	1.164	
	Frequency of communication	5.63	1.005	
	Accuracy of information	5.11	1.049	
Project team	Roles and responsibilities of project team	5.84	1.035	0.884
	Team skills and knowledge	5.11	1.179	
	Cooperation between team members	5.29	1.054	
	Commitment of team members	5.37	1.082	
	Shared clear vision of goals	5.00	1.107	
	Capability of team	5.25	1.319	
	Working relationship in team	5.29	1.128	
Project management process	Risk management	4.27	1.677	0.861
	Degree of monitoring and control	4.95	1.497	
	Implementation of pm processes and procedures	4.54	1.457	
	Change management	5.32	1.242	
	Tools and techniques	3.63	1.726	
	Frequency of feedback to client	5.65	1.246	

Table 3: Project Leadership: Inter-Item Correlation Matrix

Item	RRPM	DGOA	LAPM	SOOS	LDST
Roles And Responsibilities Of the PM [RRPM]	1.000				
Definition Of Clear Goals [DGOA]	.724	1.000			
Level Of Authority Given To PM [LAPM]	.565	.545	1.000		
Suitability Of Organisation Structure [SOOS]	.251	.422	.206	1.000	
PM's Leadership Style [LDST]	.300	.208	.234	.318	1.000

Table 4: Project Management Strategy: Inter-Item Correlation Matrix

Item	PMM	DSC	PRE	FME	BRI	APR	QPS
Project Management Methodology [PMM]	1.000						
Clear Definition Of Success Criteria [DSC]	.641	1.000					
Project Reviews [PRE]	.756	.582	1.000				
Feedback Mechanism [FME]	.716	.556	.768	1.000			
Project manager's involvement in Briefing [BRI]	.428	.578	.487	.485	1.000		
Awareness Of Project Requirements [APR]	.438	.555	.411	.476	.670	1.000	
Quality Of Plan/Strategy [QPS]	.627	.581	.655	.556	.414	.447	1.000

Table 5: Project Team: Inter-Item Correlation Matrix

Item	RRTM	TSKN	COMTM	CMTM	SCVG	CATM	WRTM
Roles And Responsibilities Of Team Members [RRTM]	1.000						
Team Skills And Knowledge [TSKN]	.530	1.000					
Cooperation Between Team Members [COTM]	.471	.454	1.000				
Commitment Of Team Members [CMTM]	.542	.473	.784	1.000			
Shared Clear Vision Of Goals [SCVG]	.493	.630	.387	.175	1.000		
Capability Of Team [CATM]	.479	.707	.481	.510	.629	1.000	
Working Relationship In Team [WRTM]	.261	.655	.405	.402	.607	.883	1.000

Table 6: Project Management Process: Inter-Item Correlation Matrix

Item	RMS	DMC	IPP	CMP	TTU	FFC
Risk Management [RMS]	1.000					
Degree Of Monitoring And Control [DMC]	.648	1.000				
Implementation Of Project Management Processes And Procedures [IPP]	.718	.744	1.000			
Change Management [CMP]	.554	.459	.590	1.000		
Tools And Techniques [TTU]	.414	.437	.471	.446	1.000	
Frequency Of Feedback To Client [FFC]	.354	.492	.345	.615	.322	1.000

Table 7: Project Information Management: Inter-Item Correlation Matrix

Item	Comp	AINF	TCOM	MCOM	FCOM	ACOI
Communication Procedures [COMP]	1.000					
Adequacy Of Information [AINF]	.524	1.000				
Timelines Of Communication [TCOM]	.565	.595	1.000			
Methods Of Communication [MCOM]	.497	.387	.570	1.000		
Frequency Of Communication [FCOM]	.377	.399	.570	.631	1.000	
Accuracy Of Information [ACOI]	.434	.581	.587	.565	.498	1.000

The second part of the analysis concerned the relative importance of the critical success factors. The ranking was based on the determined relative importance index (RII) for each item, as recommended by Chan and Kumaraswamy (1997). Chan and Kumaraswamy (1997) argued that the RII gives a more accurate representation of the relative importance than the mean and standard deviation statistics which do not show any relationship between the items. They recommended using RII which is calculated based on the following expression:

$$\textbf{Relative Importance Index (RII)} = \Sigma w / A x N$$

[Where w= weight given to each attribute, A is the highest weight and N is the total number of respondents]

Table 8: Ranking of Critical Success factors

Construct	Variable	RII	Rank
Project Team	Roles and responsibilities of project team	0.83	1
Project Leadership	Leadership style	0.81	2
Project Management Process	Frequency of feedback to client	0.81	2
Project Information Management	Frequency of communication	0.80	3
Project Management Strategy	Awareness of project requirements	0.78	4
Project Team	Commitment of team members	0.77	5
Project Information Management	Communication procedures	0.76	6
Project Management Process	Change management	0.76	6
Project Team	Cooperation between team members	0.76	6
Project Team	Working relationship in team	0.76	6
Project Leadership	Roles and responsibilities of the Project Manager	0.75	7
Project Team	Capability of team	0.75	7
Project Leadership	Level of authority given to pm	0.74	8
Project Leadership	Suitability of organisation structure	0.74	8
Project Team	Team skills and knowledge	0.73	9
Project Information Management	Accuracy of information	0.73	9
Project Information Management	Adequacy of information	0.73	9
Project Information Management	Timelines of communication	0.73	9
Project Information Management	Methods of communication	0.72	10
Project Leadership	Definition of clear goals	0.72	10
Project Team	Shared clear vision of goals	0.71	11
Project Management Strategy	Quality of plan/strategy	0.71	11
Project Management Process	Degree of monitoring and control	0.71	11
Project Management Strategy	Project manager's involvement in briefing	0.70	12
Project Management Strategy	Project management methodology	0.66	13
Project Management Strategy	Clear definition of success criteria	0.66	13
Project Management Process	Implementation of processes and procedures	0.65	14
Project Management Strategy	Feedback mechanism	0.64	15
Project Management Strategy	Project reviews	0.63	16
Project Management Process	Risk management strategy	0.61	17
Project Management Process	Tools and techniques	0.52	18

Table 8 presents the ranking of the items based on the RII. It is observed from the data that amongst the 20 factors ranked in the top factors (ranked 1-10) only three factors are related to either the project management process or project management strategy. Six out of seven of the project team factors, all of the five project leadership factors and all of the project information factors are also ranked in the top ten ranked factors. However an examination of the top five factors reveal that they all come from different constructs. A further examination of the last eight factors (rank 11-18) shows that the majority of the factors are from the project management strategy and project management processes constructs. These factors reflect more of the hard skills of project management. Based on this it can be concluded that soft issues are viewed as being critical to construction project management in comparison to the hard project management factors.

A comparison with other studies is difficult owing to the lack of consistency in the method used to define the critical success factors. It is also difficult to provide a comparison of results with the Westerveld (2003) and Bryde (2003) models as no relative rankings are presented in their papers. However the findings above are generally consistent with many other studies on critical success factors. For examples Iyer and Jha (2006) found that leadership quality, top management support, project management's team authority, understanding of responsibilities by all parties and the need for effective feedback by the project management team were ranked high. These are also found to be some of the highly ranked important factors in the present research. The results also generally compares well with Toor & Ogunlana's (2008) findings, in some of the factors. For example Toor and Ogunlana (2008) found that the hard project management issues such as control mechanism, planning tools such as work breakdown structures, use of standard software and up-to date technology were ranked lowly. This is similar to this study were generally the hard project issues are ranked lowly. It can therefore be concluded that the model presented provides a sound mechanisms for the definition of project management critical success factors.

Conclusion

The intention of the paper was to analyse the suitability of framework for examining critical success factors for construction project management. An examination of literature shows that there is a lack of agreement on what factors should be considered as critical to construction project management success. This in part is due to the lack of an agreed framework for the definition of these factors. This paper presents a model that can be used as a framework for the analysis of construction project management critical success factors. This research used a well known model, the business excellence model, to cluster different project management critical success factors as identified in literature. The findings suggest that the project management CSF model as presented in this paper, is plausible based on the results of the reliability analysis. As the business excellence model can be looked at in part, as a causal model between the enablers and the results areas, and in this case between project management and the project results, the project management CSF model represents a sound theoretical basis for the understanding of the causal relationships that exist between different project management variables. In addition to the reliability of the measurement scale, the ranking of the critical success factors is generally consistent with findings in other studies on critical success factors. This therefore shows that the project management model

presented in this paper provides a sound theoretical framework for the understanding of the influence of project management processes on construction project performance.

The authors acknowledge two key limitations with the study. Firstly the sample size, despite an acceptable response rate, is relatively small and therefore the results should be interpreted with caution. Secondly, although the model used in grouping critical success factors, shows a causal relationship, the discussion in this paper has been limited to examining the reliability of the measurement scales used and not the significance of the causal relationships between the different constructs used in the model. There is therefore a need to examination how the critical success factors collectively, both directly and indirectly, impact on project management success by examining the significance of the relationship between the different constructs.

Bibliography

Ahadzie, K., Proverbs, D & Olomolaiye, P. (2008). Critical success criteria for mass house building projects in developing countries. *International Journal of Project Management*, 26, 675–687

Alarcon, L. & Ashley, D. (1998). Project management decision making using cross-impact analysis. International Journal of Project Management, 16(3), 145-152

Anderson, D. & Merna, T. (2003). Project management strategy-project management represented as a process based set of management domains and the consequences of project management strategy. *International Journal of Project Management*, 21, 387-393

Baker, B., Murphy, D.C. & Fisher, D. (1983). Factors affecting project success. In Cleland and King (Ed.), *Project Management Handbook*. Van Nostrand

Barad, M. & Raz, T (2000). Contributing Of Quality Management Tools and Practices to Project Management Performance. *International Journal of Quality and Reliability Management*, 17, 571-583.

Belout, A. & Gauvreau C. (2004). Factors influencing project success: the impact of human resource management. *International Journal of Project Management*, 22, 1-11.

Bryde, D. (2003). Modelling Project Management Performance. *International Journal of Quality and Reliability Management*, 20 (2), 229-254

Bryde, D. (2008). Perceptions of the impact of project sponsorship practices on project success. International Journal of Project Management, 26, 800–809

Cash, C. & Fox, R. (1992). Elements of successful project management. *Journal of Systems Management*, 43(9), 10-13

Chan A., Ho, D. & Tam, C. (2001). Design and build project success factors: Multivariate analysis. *Journal of Construction Engineering and Management*, 127(2), 93-100.

Chan, A.P. & Chan, A. (2004). Key Performance Indicators for Measuring Construction Success. *Benchmarking: An International Journal*, 11(2) 2004

Chan, D. & Kumaraswamy, M (1997). A comparative study of causes of time overruns in Hong Kong Construction Projects. *International Journal of Project Management*, 15(1) 55-63

Clarke, A. (1999). A practical use of key success factors to improve the effectiveness of project management. *International Journal of Project Management*, 17(3), 139-145.

Cleland, D. (1995). Leadership and the project management body of knowledge. *International Journal of Project Management*, 13(2), 83-88

Construction Industry Council (2000). Construction project management skills, CIC

Cook-Davies, T. (2003). The "Real" Success Factors on Projects. *International Journal of Project Management*, 20, 185-190.

Cooke-Davies, T. & Arzymanow, A. (2003). The maturity of project management in different industries: An investigation into variations between project management models. *International Journal of Project Management*, 21, 471-478.

Cooke-Davies, T. (2002). The "real" success factors on projects. *International Journal of Project Management*, 20, 185-190

Crawford, J. K & Pennypacker J S. (2001). The Value Of Project Management: Proof At Last. Proceedings of *Project Management Institute Seminar/Symposium* (32nd: 2001: Nashville, Tennessee, USA), PMI

Denscombe, M. (2003). *The Good Research Guide for Small-Scale Social Research Projects*, 2nd Edition, Open University Press

Dijkstra, L. (1997). An empirical interpretation of the EFQM framework. *European Journal of Work and Organisational Psychology*, 6(3), pp321-341

Dvir, D., Raz. T. & Shenhar, A. (2003). An empirical analysis of the relationship between project planning and project success. *International Journal of Project Management*, 21, 89-95.

Fortune, J. & White, D. (2006). Framing of project success factors by a systems model. *International Journal of Project Management*, 24, 53-65

Gemunden, H., Salomo, S. & Krieger A., (2005). The influence of project autonomy on project success. *International Journal of Project Management*, 23, 366-373

Ibbs, W. C., Reginato, J. & Morris, P.W.G. (2001). Calculating the $$$ value of project management. *Proceedings of the PMI. Seminar/Symposium (32nd: 2001: Nashville, Tennessee, USA), PMI*

Kerzner, H. (2001). *Project Management: A Systems Approach to Planning, Scheduling and Controlling*, John Wiley and sons

Klien, R. & Anderson, H. (1996). Teambuilding styles and their impact on project management results. *Project Management Journal, 27(1), 41–50*

Kog, Y., Chua, D. Loh, P & Jaselskis, E. (1999). Key determinants for construction schedule performance. *International Journal of Project Management, 17(6), 351-359*

Kuprenus, J. (2003). Project management actions to improve design phase cost performance. *Journal of Management in Engineering, 19(1), 25-32*

Larson, E. & Gobelli, D. (1989). Significance of project management structure on development success. *IEEE Transaction on Engineering Management, 36(2), 119-125*

Morris, P. (2000). Researching the Unanswered Questions of Project Management. *Proceedings of the Project Management Institute Research Conference, Paris, June, 2000*

Muller, R. (2003). Determinants of external communications of IT project managers. *International Journal of Project Management, 21, 345-354*

Munns, A. & Bjeirmin, B. (1996). The role of project management in achieving project success. *International Journal of Project Management, 14, 81-87*

Pheng, L. & Chuan, Q.T. (2006). Environmental factors and work performance of project managers in the construction industry. *International Journal of Project Management, 24, 24-37.*

Pinto, J. & Mantel, S.J, (1990). The cause of project failure. *IEEE Transaction on Engineering Management, 37(4), 269-276*

Pinto, J. & Slevin, D. (1987). Critical success factors across the project life cycle. *Project Management Journal, 34(1)*

Pinto, J. & Slevin, D. (1988). Project success: definitions and measurement techniques. *Project Management Journal. (19), 67-75*

Pocock, J. & Kim, M. (1997). Impact of Management Approach on Project Interaction and Performance. *Journal of Construction Engineering and Management, 123(4), 411-418*

Qureshi, T.M., Warraich, A & Hijazi, S.T. (2008).Significance of project management performance assessment (PMPA) model. *International Journal of Project Management (2008), doi:10.1016/j.ijproman.2008.05.001*

Thamhain, H. (2004). Linkages of project environment to performance: lessons for team leadership. *International Journal of Project Management, 22(7), 533-544*

The European Foundation for Quality Management (2008). *Introducing Excellence*, EFQM

Toor, S. & Ogunlana, S. (2008). Critical COMs of success in large-scale construction projects: Evidence from Thailand construction industry. *International Journal of Project Management 26 (2008) 420–430*

Westerveld, E. (2003). The Project Excellence Model: Linking Success Criteria and Critical Success Factors. *International Journal of Project Management, 21, 411-418*

White, D. and Fortune, J. (2002). Current practice in project management- an empirical study. *International Journal of Project Management, 20, 1-11*

Yeo, K.T. (2002). Critical failure factors in information systems projects. *International Journal of Project Management, 20, 241-246.*

Zulu, S. and Brown, A. (2003). Project management process Quality: A conceptual Model. *Proceedings of the ARCOM 19th Annual Conference, University of Brighton, Brighton, September 2003, ARCOM*

Zulu, S. and Brown, A. (2004). Quality of the project management process: A conceptual Model. Proceedings of *the ARCOM 20th Annual Conference, Heriot Watt University, Edinburgh, September 2004*, ARCOM

Zulu, S. and Brown, A. (2007). Impact of Project Management on Performance: A Structural Equation Modelling Approach. *Proceedings of the ARCOM 23rd Annual Conference, University of Ulster, Belfast, 3-5th September 2007, ARCOM*