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CRITICAL FACTORS IN PROJECT SUCCESS:
A STUDY OF PUBLIC SECTOR CONSTRUCTION PROJECTS IN MALAYSIA

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DEDICATION

To my mother who showed me passion, courage and determination.

To my beloved Khalid, Khairil, Kamil and Khairina for their patience, love and devotion.

ABSTRACT

The importance of the construction industry to nation building necessitates that project implemented achieves project success. However, studies and evidence have shown that there is a low probability in consistently achieving project success. Nevertheless, it seems that the definition of project success and how to achieve project success is quite illusive. For more than a century, researchers have been grappling with its definition but the concept remained ambiguous. From the early identification of time, cost and quality as elements of project success, researchers have added many other outcomes and objectives including stakeholders, project manager, communication, leadership, project management, organization structure, resources, contract and more. Later refinements separate these elements into success criteria and success factors. This research focuses on the success criteria of time, cost quality and stakeholders' appreciation and success factor groups of human management, process, organization, and contract and technical.

The main aim of this research is to develop the components of project success and to identify the critical success factors. Other objectives are to find significant success criteria and to correlate these elements of project success. In addition the research statement emphasizes that human management is critical in the construction industry to ensure project success. The study adopts quantitative survey method and conducts a preliminary study and field survey using structured questionnaires. Data are analysed by quantitative techniques namely descriptive statistics, factor analysis and Pearson correlation.

The findings of the study reveal that the ranking of success criteria in order of importance are '*Stakeholders' appreciation*',' *Quality*', '*Time*' and '*Cost*'. But most importantly the study identifies '*Human management*' as the critical success factor group to achieve these success criteria. The subsequent ranking of the other success factor groups are '*Process*', '*Contract and technical*' and '*Organization*'. Consequently, this study defines project success as achieving the success criteria of stakeholder's appreciation, completion as specified quality, within time and cost through the success factors of human management, process, contract and technical, and organization. The contribution of this study is to stamp the importance of human management in the construction industry. This awareness will be imperative to three main groups namely the stakeholders to give emphasis on human management in project implementation, the Construction Industry Development Board to review the project management training module, and the Institutions of Higher Learning to review project management programs giving emphasis concerning human management subjects.

ABSTRAK

Pentingnya industri pembinaan untuk pembangunan negara memerlukan projek dilaksanakan dengan jaya. Namun, kajian-kajian dan eviden telah menunjukkan bahawa mencapai kejayaan projek secara konsisten mempunyai kebarangkalian yang rendah. Dan didapati bahawa definisi kejayaan projek dan cara untuk mencapai kejayan projek adalah sesuatu yang illusif. Lebih dari seabad kajian-kajian dilaksanakan untuk mendefinisi kejayaan projek tetapi konsepnya tetap masih kabur dan tidak jelas. Pada awalnya elemen kejayaan projek melibatkan pencapaian masa, kos dan kualiti. Namun kajian-kajian selanjutnya menambah beberapa hasil dan objektif termasuk pemegang amanah, pengurus projek, kommunikasi, kepimpinan, pengurusan projek, struktur organisasi, gunatenaga, kontrak, dan lain-lain. Kemudian beberapa penghalusan dibuat yang mana telah memecahkan elemen-elemen ini kepada kriteria kejayaan dan faktor kejayaan. Kajian ini memberi fokus kepada kriteria kejayaan yang melibatkan masa, kos, kualiti, dan penghargaan pemegang amanah, dan kumpulan faktor kejayaan yang melibatkan pengurusan manusia, proses, organisasi, dan kontrak dan teknikal.

Tujuan utama kajian ini adalah untuk membangunkan komponen kejayaan projek dan seterusnya untuk mengenalpasti faktor kejayaan yang kritikal. Lain-lain objektif kajian adalah untuk mengenalpasti kriteria kejayaan yang signifikan dan untuk menghubungkait kedua-dua elemen kejayaan projek. Tambahan juga, kenyataan kajian menekankan bahawa pengurusan manusia adalah kritikal didalam industri pembinaan bagi menentukan kejayaan projek. Kajian ini adalah berbentuk kuantitatif dan kajian awalan dan kajian lapangan yang sebenar telah dilaksanakan mengguna soalselidik yang dibentuk. Penganalisian data telah dibuat secara statistik mengguna teknik statistic deskriptif, analisis faktor dan korelasi Pearson.

Penemuan kajian telah menunjukkan bahawa kriteria kejayaan mengikut susunan kepentingan adalah '*Penghargaan pemegang amanah*', '*Kualiti*', '*Masa*' dan '*Kos*'. Tetapi apa yang penting sekali, kajian ini telah mengenalpasti '*Pengurusan manusia*' sebagai kumpulan faktor kejayaan yang kritikal untuk mencapai kriteria kejayaan. Susunan kepentingan kumpulan faktor kejayaan selainnya adalah '*Proses*', '*Kontrak dan teknikal*' dan '*Organisasi*'. Seterusnya kajian ini mendefinisi kejayaan projek sebagai mencapai kriteria kejayaan iaitu penghargaan pemegang amanah, menyiap projek sebagaimana kualiti, dalam masa dan kos yang ditetapkan melalui faktor kejayaan iaitu pengurusan manusia, proses, kontrak dan teknikal, dan organisasi. Sumbangan kajian ini adalah dalam memberi eviden tentang kepentingan pengurusan manusia dalam industri pembinaan. Kesedaran keatas kepentingan pengurusan manusia akan memberi petunjuk kepada tiga pihak iaitu kepada pemegang amanah dalam melaksana projek, kepada Lembaga Pembangunan Industri Pembinaan dalam menyemak modul latihan pengurusan projek, dan kepada Institusi-Institusi Pengajian Tinggi dalam menyemak program pengurusan projek agar memberi tumpuan dan keutamaan kepada aspek pengurusan manusia.

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It is indeed a lonely and a humbling journey but with the encouragement and guidance of these remarkable people, it has been an enriching and rewarding experience.

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LIST OF ABBREVIATIONS

ANOVA	Analysis of Variance
AHP	Analytical Hierarchy Process
APM	United Kingdom Association of Project Management
CCPM	Certified Construction Project Manager
CPM	Critical Path Method
DID	Department of Irrigation and Drainage Malaysia
GDP	Gross Development Product
HT	High technology
IPMA	European International project management association
IBS	Industrialized Building System
IT	Information Technology
KMO	Kaiser-Meyer-Olkin
KSA	Knowledge, Skills and Ability
LT	Low technology
MANOVA	Multivariate analysis of variance
MSA	Measure of Sampling Adequacy
NERP	National Economic Recovery Plan
PCA	Principal component analysis
PERT	Project Evaluation and Review Technique
PD	Project director
PM	Project manager
PMC	Project Management Consultants
PMI	Project Management Institute, United Stated
PSDC	Professional Services Development Council
PSM	Project stakeholder management
PWD	Public Works Department Malaysia
RAP	Rapid-application planning
RM	Ringgit Malaysia
R&D	Research and Development
SMART	Strategically Managed, Aligned, Regenerative and Transitional
SKALA	Contract, monitoring and reporting system
SPCT	Statistical Project Control Tool
SPSS	Statistical Package for Social Science
SWOT	Strengths, Weaknesses, Opportunities and Threats

CHAPTER 1: BACKGROUND OF THE STUDY

1.0 INTRODUCTION

The aim of this study is to research on issues pertaining to project success and highlighting its various criteria and factors. The study will identify the significant success criteria and critical success factors that are required to ensure project success. This chapter establishes the study by introducing the background of the problem. On the onset, the statement of the problem highlights both the importance and the ills of the construction industry that will eventually leads to the area of study namely project success. It further states the objectives, research statement, and significance of the study and the parameter of the study.

The importance of construction industry in nation building is discussed at length as the construction industry creates wealth and affects the gross development product of a country. The enormous expenditure allocated and spent for development projects make it imperative to ensure project success. However, studies have shown that not all construction projects have been successfully implemented, as Dlakwa (1990) notes that project overrun on time and cost often happens in the construction industry. Brown (1998) states that the chances of managing a project to successful completion require the application of good management practices implemented in a structured manner. However, limited resources and limited amount of time require the stakeholders to emphasize on the appropriate objectives, and organized the appropriate approach of project management (Cook, 2005). This concurs well with Campbell and Baker (2007) who assert the maxim of 'do more with less' to ensure competitiveness.

1.1 STATEMENT OF THE PROBLEM

Construction industry has been referred to as the engine of growth to any nation building. It is considered as a key sector in the government's efforts to stimulate domestic economic activities and enhancing economic growth resulting in improving the quality of life of the citizens (Badawi, 2006). The social and economic infrastructure and buildings generates wealth to the population and contribute to the economic growth of the nation (Malaysia, 2007a).

In most developing countries, the construction sector is a significant contributor to the country's economy because 50% of the investment of the country constitutes investment in construction (Dlakwa, 1990). However, in Malaysia the construction industry only contributes in average a mere 3% of Malaysia's gross development product (GDP). Nevertheless, it is one of the most important industries. This is because it enables socio-economic development and it creates a multiplier effect to other industries (Malaysia, 2007b). Consequently, the growth of these complementary industries within the various sectors of the economy namely manufacturing, agricultural, mining and services sectors will ultimately affect the nation's gross development product.

Abdul Karib (2006) and Dul (2008) illustrate the construction sector growth trend in Malaysia over a 27-year period (1980 to 2007) revealing the magnitude of the business cycle swings of the construction industry that mirrors the cycle of gross development product as shown in Figure 1.1.

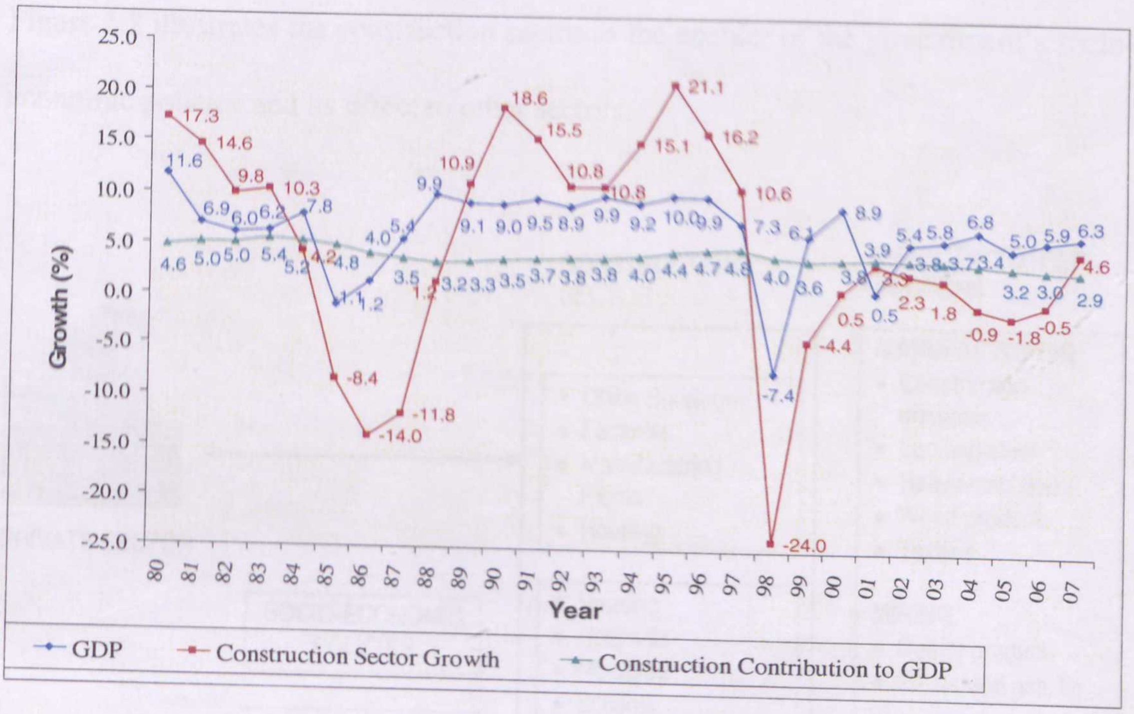


Figure 1. 1: Construction sector and Malaysian gross development product trend

Source: Abdul Karib (2006) and Dul (2008)

Due to its role as the nation's building block of socio-economic development, the construction industry has created job opportunities for more than 900,000 of Malaysia's population, not including those in other industries, and this comprise 9.0% of Malaysia's total workforce (Malaysia, 2006a). The construction industry's contributions and spill-over effect to other industries derive from its role as a large user of manufactured goods, fuel, energy and its needs of financial and professional services (Malaysia, 2007b). For RM1 billion worth of output from the building and construction industry, about RM505 million of input will be generated from domestic industries (Malaysia, 1998a). It was reported that the output of the domestic market-oriented industries declines sharply from 15.4% in 1997 to 8.8% in 1998 and this is attributed largely to the lower output of the construction-related industries (Malaysia, 1998a). The usage of products and services within these sectors enables the sectors to grow parallel to the economic growth of the nation.

Figure 1.2 illustrates the construction sector as the enabler of the government's socio-economic policies and its effect to other sectors.

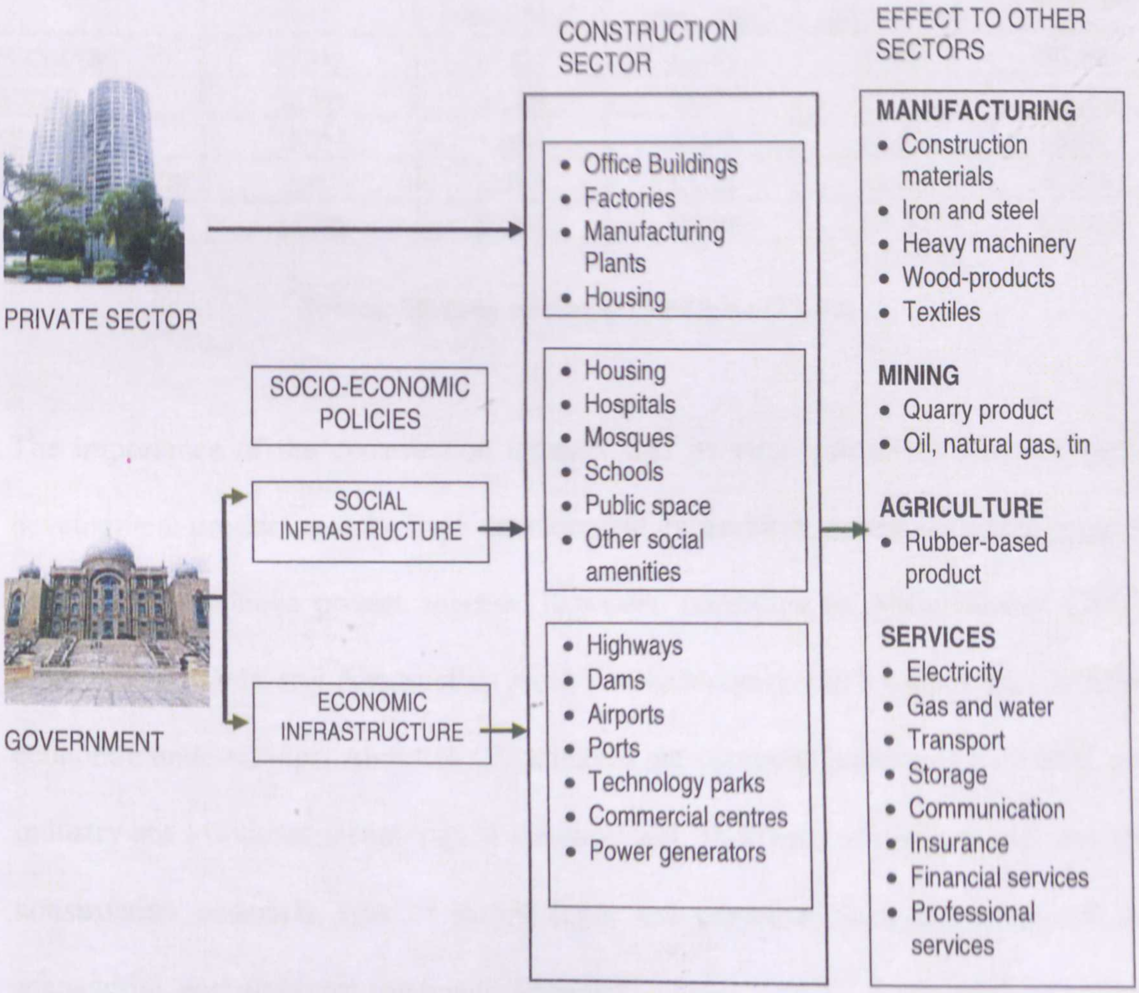


Figure 1. 2: Construction industry as an enabler and effect to other industries

Source: Adapted from Malaysia (2007b)

The amount spent by the government on development expenditure is enormous. Development expenditure are for economic, social and security sectors namely for the constructions of schools, clinics, hospitals, public facilities and infrastructure. Table 1.1 shows the development expenditure by the federal government for the various 5-year Malaysia plans from 1990 to 2010 (Malaysia, 2007a). The total expenditure is in excess of Ringgit Malaysia (RM) 600 billion that reflect the government spending and commitment on nation building which subsequently spurred the construction industry.

Table 1. 1: Federal government development expenditure for 6^{th} – 9^{th} Malaysia Plan

SECTORS (RM million)	6th Malaysia Plan (1990 -1995)	7th Malaysia Plan (1996 – 2000)	8th Malaysia Plan (2001 – 2005)	9th Malaysia Plan (2006 – 2010)*	TOTAL (RM million)
ECONOMIC	27,712	47,172	65,446	89,886	281,144
SOCIAL	13,555	31,384	69,377	74,954	207,907
SECURITY	10,987	11,644	22,042	21,203	75,897
ADMINISTRATION	2,451	8,937	13,135	13,957	40,414
TOTAL	54,705	99,037	170,000	200,000	605,362

* Allocation

Source: Ministry of Finance Malaysia (2007a)

The importance of the construction industry and its vital link to the national gross development product and the huge development expenditure necessitates that projects implemented achieve project success. However, according to Abdul-Rashid (2002) the level of risk in any construction work is considerably much higher than in other economic undertakings. Abdullah (2004) notes the common features of a construction industry are low-level technological development, shortages of plant, equipment and construction materials, lack of skilled labor and personnel including technical and managerial, and problems relating to financial.

Problems in the construction industry are not isolated to Malaysia alone. Even developed countries like United Kingdom faces similar problems. Latham report (1994), commissioned by the government of United Kingdom to end 'the culture of conflict and inefficiency that dogs Britain's biggest industry', reviews the state of its construction industry critically. The industry was reported as 'ineffective', 'adversarial', 'fragmented', 'incapable of delivering for its customers', and 'lacking respect for its employees'.

As such, managing construction projects within such environment is difficult and successful completion is not the norm (Nguyen et al, 2004). Henrie and Sousa-Poza (2005) claim that all these years, studies and evidence have shown that projects have a low probability in consistently succeed in achieving the time, cost and quality objectives. And budget that exceeded by more than 50% of the project cost are common (Thompson, 1999). In fact, a review of 3,500 projects from all over the world and from various industries reveals that on average, all projects reported a cost overrun and it is between 40% to 200% of the contract sum (Morris and Hough, 1987). Tan (2004a) states that project failures are a 'worldwide common phenomena' and are acknowledged universally as customary in construction industry.

According to the report by the comptroller and auditor general (National Audit United Kingdom, 2001) the performance of government agencies in implementing construction projects highlighted inefficiencies in delivery of projects where 73% were over budget and 70% were delivered late as shown in Figure 1.3.

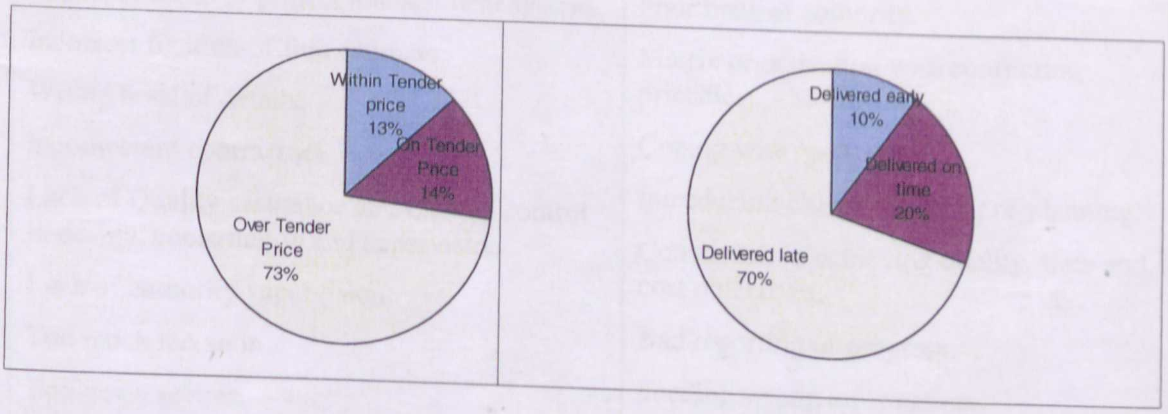


Figure 1.3: Performance of government agencies construction projects

Source: National Audit United Kingdom (2001)

The Standish Group (1995) reported failures in the information technology projects in all industries including construction industry based on a research project carried out with 365 respondents as follows: 53% responded cost overruns of more than 50%, 67.8% responded time overrun of more than 50% and 68.2% responded projects completed with more than 50% content deficiencies. On average, the success rate for software projects defined as on-time and on-budget is only 16.2%.

A case study by Kanter and Walsh (2004) suggests that the major problems of unsuccessful projects are due to communication, schedule, skill, design, requirement, leadership, planning, resources, testing, and monitoring and control. Tan (2004a) describe various reasons for construction project failures that are due to various stakeholders' faults. These reasons are tabulated in Table 1.2.

Table 1.2: Reasons for project failures

Reasons for failures	Project management failures
Insufficient funds.	Incompetent and incompatible team.
Improper focus of project management system.	Poor lines of authority.
Incorrect fixation of first estimate.	Matrix organization with conflicting priorities.
Wrong level of details.	Coping with 'politics'.
Incompetent contractors.	Introducing changes without re-planning.
Lack of Quality assurance and Quality control in design, construction and supervision.	Constraints in achieving quality, time and cost objectives.
Lack of authority supervision.	Bad reporting of progress.
Too much too soon.	Feeding wrong information.
Too many people.	Overly optimistic of completion dates.
Lack of common project goals.	Insufficient project definition.
Rewarding wrong actions which does not contribute to achieving project goals.	Inaccurate estimates and forecast.
	Changes in client's requirements.

Source: Adapted from Tan (2004a)

To ensure project success is not an easy task as it involves numerous dynamic issues and factors. However, for more than a century, researchers have been grappling with the concept and what comprises project success. Young (1993), and Campbell and Baker (2007) state that it is not just the planning that is important in ensuring project success but the myriad of activities in organizing, scheduling, executing, tracking and controlling the cost and the resources of the project. Nokes and Kelly (2007) emphasize the numerous problems of a project manager that includes knowing 'what is wanted, what inputs need to get there, what processes must be performed and in what order'.

The literature with regard to project success is numerous and in abundance. Every author has his own idea and belief, supposition and hypothesis that may support or differ from each other. In fact, although there are many literatures on project success, there is relatively little empirical data on the subject (Collins and Baccarini, 2004). In addition, the terms used with regard to the success criteria and success factors are sometimes used differently. This has caused some confusion in defining project success. Shenhar et al (2002) observe that although studies have been carried out, these authors postulated that there is no conclusive evidence or consensus on what constitute project success and the factors for project success. Their research suggests three areas of concern that are found in previous researches and thus needs further investigation and these are: (1) not connecting the multidimensional assessment of project success to project success factors, (2) focusing only on a single aspect of the management of the project, and (3) not focusing on strategic and managerial aspects. Similarly Ngunyen et al (2004) reiterate the concerns as they claim that previous studies either provide too general or too specific success factors that are difficult to be applied in practice.

However, according to Wateridge (1995), the need to choose appropriate critical success factors at the start of the project is of utmost importance. These critical success factors can be used as a guide to stakeholders' behavior (Liu and Walker, 1998) and a key determinant of project success (Kanter and Walsh, 2004). In addition, Clarke (1999) argues that managing equally all the project success factors at the same time would be impractical and unachievable. He advocates adopting the Pareto principle of 'separating out the important few from the trivial many' by giving attention and concentrating on the critical factors that would most likely ensure project success. Kanter and Walsh (2004) reiterate this point stating that the key to success is identifying the critical success factors and expend all the energy on these factors instead of the many lesser important factors.

The question of whether one set of critical success factors can be applied to any industry and the similar set of critical success factors applied to any project have also been reviewed. Rockart (1982) notes that although critical success factors differ among industries, a generic set of critical success factors can be easily identified for each industry and applicable to any project. On the other hand, Leidecker and Bruno (1984) and Lui (2004) argue that although generic variables can be identified which are similar to all the industries, one set of critical success factors identified may not be transferable to another project. Westerveld (2003) acknowledges a need for a management model that link these critical success factors to project success criteria that would assist project managers deals with projects that are becoming more complex.

Nevertheless, Clarke (1999), and Bryde and Brown (2004) postulate that project success is not dependent of only one critical factor but rather a number of factors that are inter-related and inter-dependent to each other that requires a holistic approach. The numerous project success factors should be grouped, as the combined effects would eventually lead to project success (Schultz et al, 1987, Clarke, 1999, Bryde and Brown, 2004, and Nguyen et al, 2004). Studies by various researchers have shown the importance of groups of factors to achieve project success but human or people factor seems to be a common denominator (Belout, 1998, Belassi and Tukel, 1996, Hartman and Ashrafi, 2002, Shenhar et al, 2002, Cooke-Davies, 2002, Clarke, 2002, Cooke-Davies and Arzymanow, 2003, Kanter et al, 2004, Nguyen et al, 2004, Henrie and Sousa-Poza, 2005, and Iyer and Jha, 2005).

1.2 RESEARCH STATEMENT

This study basically examines the components of project success that comprise the two elements of success criteria and success factors. The aim of studying project success is to explain what it takes to achieve the successful implementation of a project. Thus this will indentify and guide the stakeholders to focus on these success aspects. The research statement is derived from the literature review and the preliminary study. The factors that are commonly highlighted in literatures on general management, project management, construction management and contract management are with regards to "human, process, organization, and contract and technical". These four terms are taken in this study to classify or group individual success factors as scholars postulated that the combined effect of individual factors should be analyzed.

Based on the categorization on the critical success factors, the research statement for this study is: Human management is critical in the construction industry to ensure project success.

1.3 OBJECTIVES AND SIGNIFICANCE OF THE RESEARCH

The main objectives of this study are as follows:

1. To develop the components of project success.
2. To find significant project success criteria by ranking the criteria.
3. To find significant project success factors.
4. To identify the dominant critical success factors by ranking the factors.
5. To correlate the project success factors to project success criteria.

The research will be beneficial in the attempt to answer the question of what are the critical factors for project success in the context of the Malaysian construction industry. The research will be a contribution to the stakeholders in the construction industry as it will be a basis for them to give emphasis on what matters most in project success. With the scarcity of resources, choices and priorities are necessary to be made by stakeholders to ensure that what is most important and relevant will be given more consideration.

In recognizing the critical success factors, the stakeholders of a project will be able to allocate limited resources of time, manpower and money appropriately (Chua et al, 1999). The stakeholders will be able to focus energies and resources (Jiang and Heiser, 2004), enabling a shared and common understanding (Bryde and Brown, 2004) to these key variables or key areas as a means to improve effectiveness and ultimately to ensure the success of the project (Chan et al, 2004). This is possible because these key variables have a great impact on a firm's competitive position as they give the organization an instrument to evaluate its threats, opportunities, strengths and weaknesses (Leidecker and Bruno, 1984). These are the managerial areas where things must go right that would ensure successful competitive and high performance (Rockart, 1982, and Boynton and Zmud, 1984). However, these critical success factors must be maintained in order for teamworking to take place in an efficient and effective manner. (Jefferies et al, 2002).

Upon identifying the critical success factor, this would in addition have an impact on the content of training modules on project management for project managers conducted by the Construction Industry Development Board Malaysia and improving the curriculum and content of the course module for project management and professional programs in the Institutions of Higher Learning.

1.4 RESEARCH METHODOLOGY

The study begins with exploratory work to focus on current and pertinent issues that will enable to identify a clear and precise statement of problem. Subsequently the research performs a thorough literature review on the area of study and adopts quantitative survey method conducting a preliminary study and field survey as the strategy for data collection. All data are analysed by quantitative techniques namely descriptive statistics, factor analysis and Pearson correlation. Statistical Package for Social Sciences (SPSS) is the main tool in assisting the data analysis. The research methodology is further discussed in Chapter 4.

It is to be noted that all the figures and tables shown in this thesis are based on this research unless otherwise stated.

1.5 PARAMETER OF STUDY

The parameter of the study is limited to the implementation of construction projects in the public sector within Semenanjung Malaysia in which this sector has proper records and documented evidence as compared to private sector. The respondents for this study, as further described in Chapter 4, are project directors and project managers from project management consultants (PMC) registered with the Ministry of Finance Malaysia, and project management teams in the government's implementing agencies namely the Public Works Department Malaysia (PWD), Department of Irrigation and Drainage Malaysia (DID) and Ministry of Finance.

1.6 OUTLINE OF CHAPTERS

This thesis is structured as follows

Chapter 1: Introduction. A brief discussion of the topic.

Chapter 2: The concept of project success. This chapter provides the definition of project, project management, concept of critical success factors, project life cycle and components of project success. It will also discuss the various success criteria and success factors.

Chapter 3: Procurement and the implementation of construction project in Malaysia. This chapter examines the procurement of projects in public and private sectors in Malaysia.

Chapter 4: Research methodology. This chapter is a review of methodology used.

Chapter 5: Analysis and findings. This chapter presents the result of the survey conducted.

Chapter 6: Conclusion and recommendations. This chapter concludes the findings of this thesis. It also proposes some recommendations for the Malaysian construction industry.

1.7 CONCLUDING REMARK

Chapter 1 discussed the topic and research area of the thesis. The focus of the study is with regard to project success comprising the success criteria and success factors. In addition the research statement emphasize that human management is critical in the construction industry.

The following chapter explores the literature review with regard to the topic in general and project success in particular.

CHAPTER 2: THE CONCEPT OF PROJECT SUCCESS

2.0 INTRODUCTION

This chapter is the literature review on the concept of project success. It starts with defining and highlighting issues concerning implementing projects. These issues are with regards to project, project management, project lifecycle and the concept of critical success factors.

It further discusses the attempt by numerous authors to define project success. The literature review reveals that project success comprises two dimensions namely the success criteria and success factors. However many previous researchers used these terms interchangeably. This chapter lists all the success criteria and success factors as identified by the various authors. The success factors are further reduced to significant factors that are then classified under factor groups by using factor analysis as discussed in Chapter 4. The literature review on success factors in this chapter is confined to the identified significant factors and factor groups.

2.1 DEFINITION OF PROJECT

Gaddis (1959) was among the first to provide with a descriptive definition of a project as it goes beyond the boundaries of a project being a static task. He defines a project as 'an organization unit dedicated to the attainment of a goal – generally the successful completion of a developmental product on time, within budget, and in conformance with predetermined performance specifications'. Similarly, Walton (1984), Kerzner (2000), and Gray and Larson (2006) define a project as interrelated activities performed within time, cost and resources to meet the required needs.

Others offer a simpler definition of project. The definition that takes into account resources: an undertaking to achieve defined performance, budget and schedule (Morris and Hough, 1987), and a one-time multitask job that has performance, time, cost and scope (Lewis, 2001). Other definition that include having objectives: a complex effort to achieve specific objectives (Lai, 1997 and Ruin, 2004), and a planned set of activities meeting specific goals and outputs (Angelides, 1999). Yet other definition include: a task limited in time and effort (Knoepfel, 1992), unique, novel and transient requiring knowledge, skills and abilities to meet client needs (Keegan and Turner, 2003), a complex time restricted and unique endeavor (Dov and Lechler, 2004), and a temporary endeavor undertaken to create a unique product or service (Project Management Institute, 2004).

Definition of construction project are given as: a complex sequence of activity to deliver a clearly defined objectives (Cheung, Tam, Ndekugri and Harris, 2000), and a complex system of a large number of interrelated and interconnected elements, various organizational units and a wide variety of people (Ogunlana et al, 2002). According to Frigenti and Comninos (2002), the three factors that differentiate projects from routine operations are that it is unique, temporary nature and progressive elaboration. In addition, a project is performed by people, constrained by limited resources and, should be planned, executed and controlled.

In summary, the main characteristics of a project derived from the definitions by the various authors are that it is unique and complex, has a sequence of interrelated activities, to achieve a specific objective or goal, consumes resources and completes within a specific time, within the approved budget and according to the required specification.

2.2 PROJECT MANAGEMENT

2.2.1 Definition of project management

Since the 1950s, there have been many attempts to define project management. There are many different definitions that range from narrow to a wide application attempting to cover every possibility (Smith, 1994). Traditionally, it has been described as managing resources on a given activity, within the constraint of time, cost and performance with the existence of tradeoffs among them (Kliem and Ludin, 1992). Soderland (2004) credits Gaddis (1959) as the first author to define project management that include the element of managing the project to ensure completion on time, within budget, and required specifications. Atkinson (1999) terms these three elements as 'The Iron Triangle' as shown in Figure 2.1, while others called them the priority triangle, project criteria triangle, triple constraints or three project objectives.

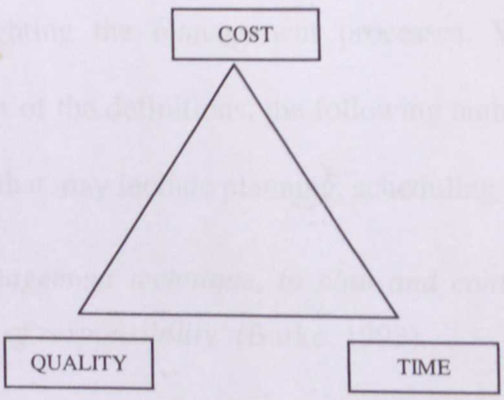


Figure 2.1: The Iron Triangle

Source: Atkinson (1999)

There seems to be several views with regard to defining project management (Delisle and Olson, 2004). However, in reviewing the literature, two views come into prominence. One set of definition links 'The Iron Triangle' of time, cost and quality; and the other define project management based on the processes.

The following set of definitions highlights the achievement of the iron triangle.

> *'the planning, monitoring and control of all aspects of a project and the motivation of all those involved in it to achieve the project objectives on time and to the specified cost, quality and performance' (BS6079, 1996).*

> *'managing and directing time, material, personnel and costs to complete a project in an orderly, economical manner and to meet the established objectives of time, costs and technical and/or service results'* (Spinner, 1997)

> *'a series of activities embodied in the process of getting things done on a project by working with members of the project team and with other people in order to reach the project schedule, cost and technical performance objectives'* (Cleland, 1999).

Another set of definitions does not explicitly include the constraints of time, cost and quality but rather highlighting the management processes. While there may be differences in the construct of the definitions, the following authors are similar in the inclusion of the processes that may include planning, scheduling and controlling.

> *'a specialized management technique, to plan and control projects under a strong single point of responsibility'* (Burke, 1993).

> *'planning, scheduling and controlling of a series of integrated tasks such that the objectives of the stakeholders are achieved successfully and in the best interest of the project's stakeholders'* (Kerzner, 2000)

> *'the process by which the appointed project manager plan, organize, schedule, implement, manage, monitor, control, track, solve problems, make decisions, lead, inspire and motivate the entire project consortium team involved in a project that consume resources in order to achieve set and stipulated project objectives....'* (Tan, 2004b)

Other simpler definitions emphasize on managing change (Bennett, 1994), in terms of achieving the required objectives (Turner, 1996, Munns and Bjeirmi, 1996, and Frigenti and Comninos, 2002), and the application of knowledge, techniques, tools and skills (Kenny, 2003).

Similarly, there are differences in emphasis on the body of knowledge by the various project management institutes namely the Project Management Institute, United States (PMI), the Association for Project Management, United Kingdom (APM) and the International Project Management Association (IPMA) in Europe. PMI focuses on generic processes required to achieve time-cost-quality objectives, APM emphasizes on technological, commercial and general management context essential to implement project successfully and IPMA comprises all the competence guidelines (Morris, 2001). These differences reveal the intricacies and 'confusion' on the philosophy of project management.

Project Management Institute (2004) defines project management as 'the application of knowledge, skills, tools and techniques to project activities to meet project requirements.' The processes involve in project management are initiating, planning, executing, controlling and closing. It goes on to describe nine knowledge areas generally accepted to be essential or practices in a project management profession or organization. Table 2.1 is the mapping of the fit between the project management processes and the knowledge areas including the relevant deliverables that include project plan, scope plan, schedule, quality plan, communication plan, risk management plan and others.

Table 2.1: Mapping of project management processes to the knowledge areas

PROCESS / KNOWLEDGE	INITIATING	PLANNING	EXECUTING	CONTROLLING	CLOSING
1. Integration		Project plan development	Project plan execution	Integrated change control	
2. Scope	Initiation	Scope planning Scope definition		Scope verification Change Control	
3. Time		Activity definition Activity sequence Activity estimate Scheduling		Schedule control	
4. Cost		Resource plan Cost estimate Cost budget		Cost control	
5. Quality		Quality planning	Quality assurance	Quality control	
6. Human Resource		Organizational planning Staff acquisition	Team Development		
7. Communication		Communication planning	Information Distribution	Performance reporting	Admin-istrative Closure
8. Risk		Risk management plan Risk identification Qualitative analysis Quantitative analysis Risk response planning		Risk monitoring and control	
9. Procurement		Procurement plan Solicitation plan	Solicitation Selection Contract administration		Contract closeout

Source: Project Management Institute (2004)

APM defines project management as 'The planning, organization, monitoring and control of all aspects of a project and the motivation of all involved to achieve the project objectives safely and within agreed time, cost and performance criteria' Morris (2001). It structures its body of knowledge into the four key competences of Project, Organization and People, Techniques and Procedures and General Management as shown Table 2.2.

IPMA structures the body of knowledge in a sunflower formation due to the differences of the countries' associations in agreeing with the way the topics are to be structured (Morris, 2001). This is shown in Figure 2.2.

Table 2.2: The APM body of knowledge structure

Project	Organization and People	Techniques and Procedures	General management
System management Program management Project management Project life cycle Project environment Project strategy Project appraisal Success criteria Integration Systems procedures Closeout Post project appraisal	Organization design Control & coordination Communication Leadership Delegation Team building Conflict management Negotiation Management development	Work definition Planning Scheduling Estimating Cost control Performance measurement Risk management Value management Change control Mobilization	Operation/technical Management Marketing & sales Finance Information technology Law procurement Quality Safety Industrial relations

Source: Morris (2001)

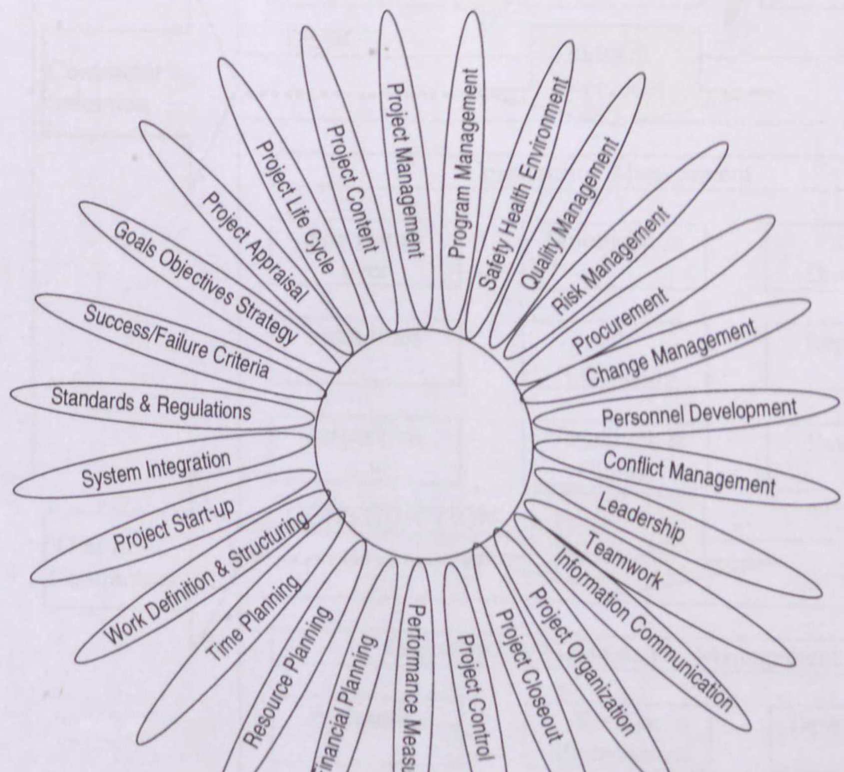


Figure 2.2: 'The Sunflower' structure of IPMA competence baseline

Source: Morris (2001)

Smith (1994) observes that compared to other industries, the construction industry is the earliest to use the project-management methods. Al-Sedariy (1994) constructs a model of a total project management for construction works to demonstrate the main activities involved as shown in Figure 2.3.

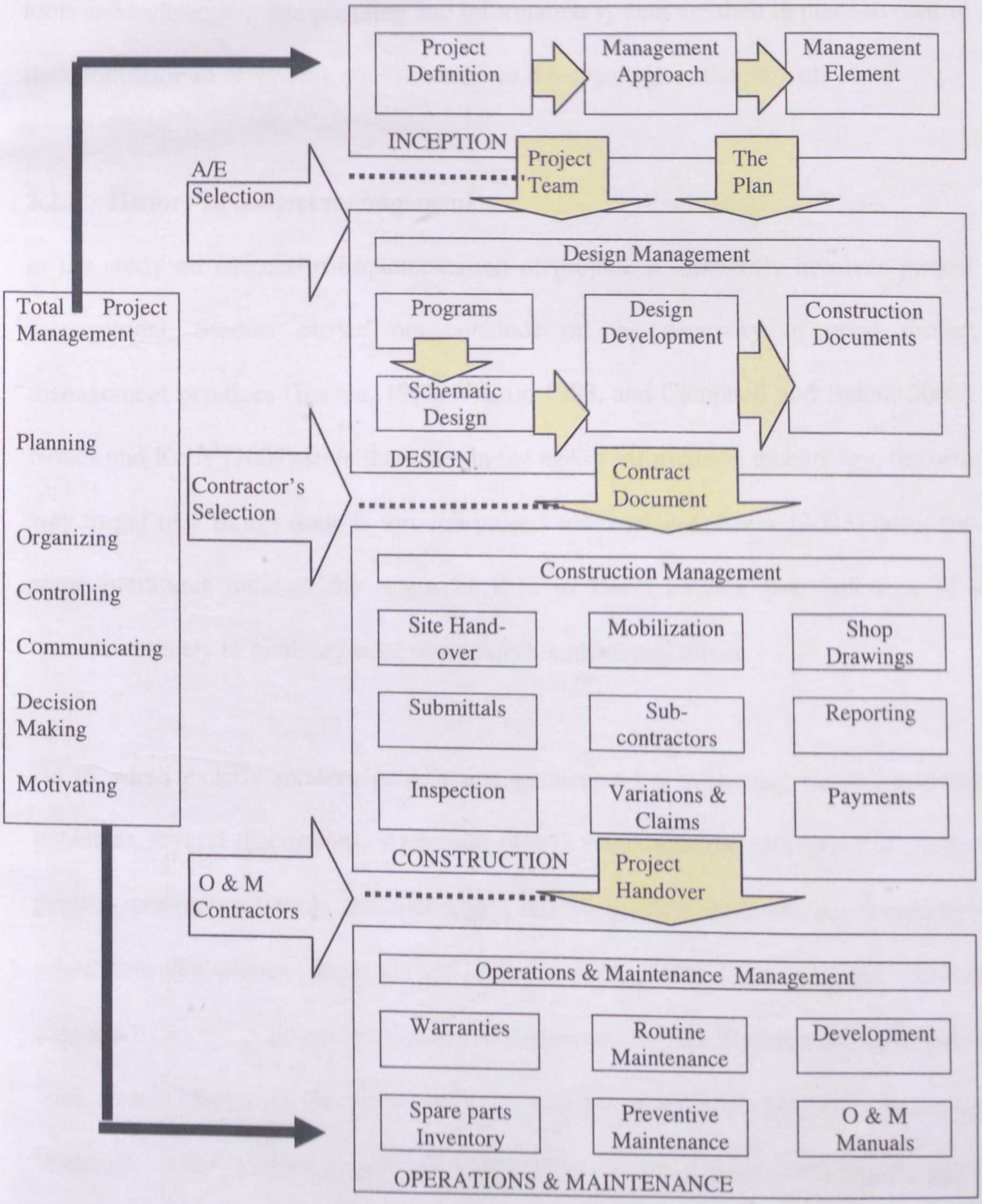


Figure 2.3: Total project management system for construction

Source: Al-Sedariy 1994

Lewis (1995) constructs a project management system that comprises seven components in a pyramid structure. These components are methods, culture, organization, planning, information and control with the human elements forming the base of the pyramid. These are supported by a clear organizational structure with a culture system that influence positive behaviors and backed by proper methodologies, tools and techniques. The planning and information system are then in place to control the application of scarce resources to achieve the objective of the project.

2.2.2 History of project management

In the study on successful implementation of project, it inherently involves project management. Studies carried out conclude on the necessity of good project management practices (Brown, 1998, Young, 1993, and Campbell and Baker, 2007). Nokes and Kelly (2007) state that even in the age of information technology, the only way to get new things done is through project management. Kwak (2003) notes that some literatures indicate the origin in 1916 to Henri Fayol's five functions of a manager namely to plan, organize, coordinate, control and direct.

As to when exactly modern project management takes form and its raison d'être generates several discussions. Archibald (1987) states that the utilization of modern project management tools and techniques started in 1958 with the development of scheduling techniques using critical path method (CPM) and complex network diagram using program evaluation review technique (PERT). Soderlund (2004) puts it back much earlier in the early 1900's when he argues that project management researches points to Henry Gantt as the father of modern project management due to his Gantt chart that has become a standard model in project management practice.

Morris and Hough (1987) argue that modern project management originates from the chemical industry in 1940's but Morris (2001) postulates that it is in the 1950's when the U.S defense and aerospace sector further enhance the project management techniques that later becomes a core competence to other industries. However, Sisk (2001), and Cleland and Ireland (2002) claim that modern project management only begins in the early 1960's as businesses realized the importance of project management tools and techniques especially the need for better communication. However, Kwak (2003) argues that the evolution of project management parallel to the changes in technology and management science as summarized in Table 2.3.

Table 2.3: Four periods of project management

	Theme	Technology	Management science	Project management tools and techniques
Prior to 1958	Craft system to human relations administration	Telegraph, Telephone, First computer, Automobile, Airplane First database.	Adam Smith, Frederick Taylor, Henry Fayol, Henry Gantt, McGregor's XY Theory	Parametric cost estimating, PERT/ CPM, Gantt Chart, Systematic application
1959 – 1979	Application of management science	IBM 7090, Xerox copier, UNIX, Microsoft founded.	ISO, TQM, Globalization, Quality Management	PMI, Inventory control, Material requirement planning
1980 - 1994	Production center - human resources	Personal computer, Wireless network, Internet browser.	Manufacturing resource planning, Risk management	Matrix organization, Project management software
1995 – current	Creating a new environment	Internet	Critical chain, Enterprise resource planning	Project Management Body of Knowledge

Source: Adapted from Kwak (2003)

(a) Prior to 1958: Craft system to human relations administration

During this period, project management is influenced by the application of Frederick Taylor's scientific management (Sisk, 2001), the visualization tool of the Gantt chart (Soderland, 2004) and the advancement of technology (Kwak, 2003). The advert of scientific management shows that project implementation can be improved by analyzing on each work breakdown components of the project. The Gantt chart requires the analytical sequencing, order and duration of each task of the project. The advancement of technology affects the way projects are implemented due to effective and speedy mobility and communication.

(b) 1958-1979: Application of management science

Project management is further influenced by the development of management science, PERT, technology advancement and implementation of large-scale government projects. Sisk (2001) notes that it was during this period project management evolved from management principles due to increasing complexities of businesses. In addition, complex network diagrams and critical path of PERT chart enable the progress of the project to be effectively controlled and monitored and later would become an integral part of project management (Fondahl, 1987). Kwak (2003) also observes that during this period, advancement in technology is taking place in a tremendous pace. This includes the paper copier Xerox, minicomputers, microprocessor, Intel and Pentium processors, e-mail software, project management software and Microsoft. The implementation of large-scale government projects provides the required momentum to utilize modern project management process, tools and techniques.

(c) 1980-1994: Production center - human resources

This period witnesses various studies regarding project organizations, project uncertainties and project risk (www.indiainfoline.com). Kwak (2003) notes that the advancement of computer technology support the enhancement of project management theories, tools and techniques resulting in higher efficiency and better control of project schedules. This is further improved with the advert of personal computer and the introduction of internet technology over network technology.

(d) 1995 - current: Creating a new environment

Sisk (2001) views the period between the mid 1990's and the present as an era where emphasis is on human issues. This includes the focus of project management on the project manager, the team, the integration and the communication of the workflow horizontally across different departments. Kwak (2003) postulates that the rapid advancement of technology especially the fast and interactive internet have change business and project management practices positively. This permits browsing, purchasing, tracking of products and services online instantly that results in efficiency in the controlling and managing of projects. Soderlund (2002) summarizes the development of modern project management into two theoretical roots. The first is through the engineering science and applied mathematics emphasizing on the scheduling and planning techniques. The second root is after 1980's where the development of project management is through progressing from hard skill to soft skill emphasizing on human aspects and organization.

2.2.3 The role of project management in achieving project success

Munns and Bjeirmi (1996) observe that it was only since 1960's project management start to be known as a tool to manage projects. Through the years, project management is increasingly being used as an effective tool in the implementation of successful project (Salapatas, 1981, Barnes and Wearne, 1993, Arora, 1995, Pinto and Kharbanda, 1996, Jaafari and Manivong, 1998, Angelides, 1999, Kerzner, 2000, Jugdev and Thomas, 2002, Thomas et al, 2002, Czuchry and Yasin, 2003, Kenny, 2003, Soderlund, 2004, Longman and Mullins, 2004, Milosevic and Patanakul, 2005, and Gray and Larson, 2006).

Project management brings together the tried and tested tools and techniques that focus on the successful implementation of a project (Newell, 2001). The role of project management is to define works requirements, allocate the required resources, plan and execute the work, and monitor and control progress and deviations (Munns and Bjeirmi, 1996). It is concerned with identification of the client's objectives in terms of utility, function, quality, time and cost, and the establishment of relationships between resources. According to Easton and Day (1981) the most important benefits of project management and its philosophy is the rigorous organization, planning and control functions. The responsibility for budgeting cost control, schedule, resource allocation, technical quality, and management of client, customer and public relations is centralized through the project manager.

Angelides (1999) claims that good practice and project management will be able to reduce any competing demands between the project objectives of time-cost-quality whereby these objectives could be concurrently achieved without unnecessary trade-offs. According to Soderlund (2004), studies on project management largely were committed in the search of generic project success factors as project management is seen to be the tool to solve complex organizational problems that would enable successful implementation of project.

However, the Project Management Institute (2004) cautions that although managing project is important it may not be sufficient for project success. Similarly, a study by Cook (2004) leads him to believe that whilst the adoption of project management practices has a positive impact on project success, it is not a guarantee for success. Jonason (1971) indicates that organizations had begun to realize that using project management approach has too often failed to live to its hype.

Project management may increase the certainty of achieving project success but it may not be the ultimate raison d'être for success (Project Management Institute, 2004, Reiss, 1995) as the success or failure of a project is not totally dependent of project management alone (Tan, 2004a). Successful project management techniques will contribute to the achievement of projects but project management will not stop a project from failing to succeed. It is thus important that a distinction should be made between project management success and project success (De wit, 1988, Clarke, 1999, Collins and Baccarini, 2004).

Project management success deals with the successful accomplishment of cost, time and quality objectives and the way the project management process was carried out in satisfying the project stakeholders (Baccarini, 1999, Collins and Baccarini, 2004, Tan, 2004a). Project success includes handover to end-users and its utilization, the effects or the long term interest of the project's final product namely achieving project owner's organizational objectives, and satisfaction of stakeholders' needs (Baccarini, 1999, Collins and Baccarini, 2004, Tan, 2004a), that includes maintenance, facilities management and project close-down. In addition, for private sector, project success also involves the profitability and marketability of the project (Tan, 2004a).

Munns and Bjeirmi (1996) illustrate the distinction between project management success and project success in Figure 2.4. The focus of the project management team will be on the task of successfully planning, executing and completion of the project and proceed with their next project, whereas the client is concerned until the end of the closedown stage. Munns and Bjeirmi (1996) postulates that the scope of project management success is until stage 4 and the scope of project success is until stage 6.

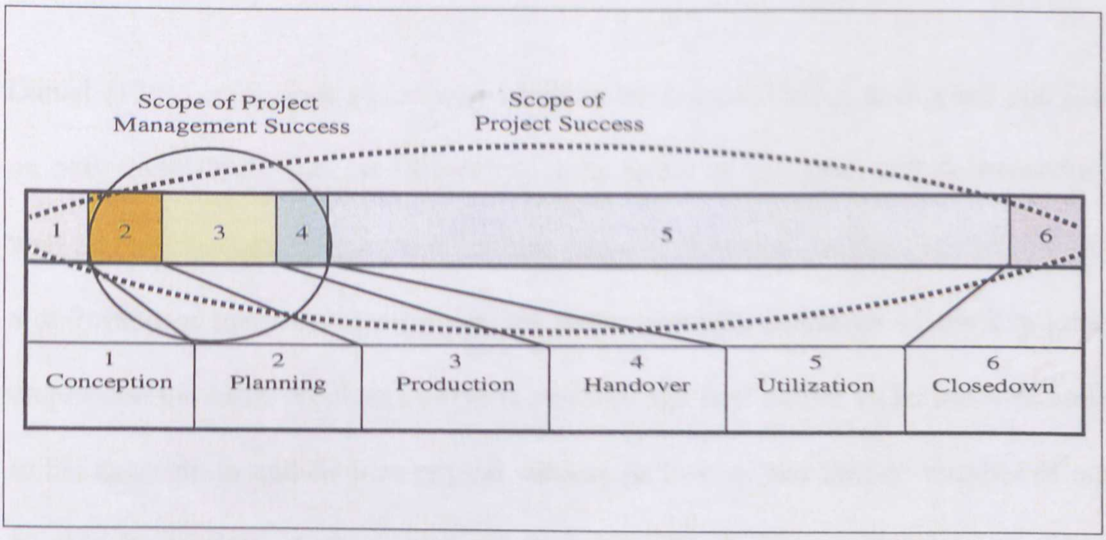


Figure 2.4: The scope of success within the project life cycle
Source: Munns and Bjeirmi (1996)

Accordingly, Lim and Mohamed (1999) and Jugdev and Muller (2005) quote the Sydney Opera House, which took 15 years to build and cost 14 times the budget. Based on the overruns the project is a failure in terms of project management success but a success in terms of product success as it become Australia's landmark and seen as an engineering work of art.

2.3 CRITICAL SUCCESS FACTORS

2.3.1 Definition of critical success factors

Daniel (1961) is the first to introduce the concept of success factors in his article regarding crisis in companies due to rapid organizational change. However, Leidecker and Bruno (1984) state that the concept did not spark any interest until 1970's. Later, Rockart (1979) develops the concept of critical success factors in the context of project management. Subsequently, other authors began to adopt this concept in the context of strategic management (Boynton and Zmud, 1984 and Jefferies et al, 2002). The term critical success factors has also been known as key variables, strategic factors, key jobs, key result areas or pulse points.

Daniel (1961) states that a company needs to be discriminating, and select and focus on only three to six success factors which he terms as key jobs, and do exceedingly well on these success factors to determine success. However, he does not provide with a definition of these success factors but rather provides examples of the key jobs to emphasize the term. Rockart (1979) is amongst the first author to be more definitive in his description and defines critical success factors as 'the limited number of areas in which results, if they are satisfactory, will insure successful competitive performance for the organization. They are the few key areas where things must go right for the business to flourish'.

Various authors further refine the definition of critical success factors. Generally, it is defined as those tasks (Munro and Wheeler, 1980), those characteristics, conditions or variables (Leidecker and Bruno, 1984), those few things (Boynton and Zmud, 1984), and those fundamental issues (Jeffries et al, 2002) that are vital, and influence and have major impact on success of a firm. These critical success factors must be properly sustained, maintained and managed.

Early definition of critical success factors concentrate mainly on profitability and competitive advantage of firms in their particular industry. There may be differences between the critical success factors between industries. But, for each industry a set of common critical success factors can be easily identified that is unique for that particular industry (Jiang et al, 1996, and Cleland, 1999). Later, these dimensions were questioned by other researches. Lui (2004) asserts that her studies regarding critical success factors from various industries namely from financial services to engineering, results in generic variables which are similar to all the industries.

Leidecker and Bruno (1984) argue that identifying a set of critical success factors is not an easy task due to weaknesses in the method used. Jefferies et al (2002) note that researchers claim the weaknesses are due to subjectivity, bias, human limitation, changes in environment, generalization and qualitative performance measures. However, Liu (2004) and Hartman and Ashrafi (2004) state that one set of critical success factors that have been identified may not be applicable to another project due to differences in environment, type and complexity of project, nature of stakeholders and priority of project goals.

2.3.2 Choice of critical success factors

Leidecker and Bruno (1984), advocate that identifying the critical success factor is an integral part of the strategic planning of a company. According to Lui (2004), studies regarding critical success factors are based on the respondents' perceptions of what denotes success and the weakness of these perceptions are the threat of bias and the inaccurate interpretation of actual environment. Cooke-Davies (2002) claims that the choice of which success factors are critical may be determined by identifying the factors that consistently emerge in project management success and project success.

2.4 PROJECT LIFE CYCLE

2.4.1 Definition of project life cycle

All projects will go through a sequential series of phases from conception to termination called project life cycle. Project stakeholders used the project life cycle to depict the timing of the main tasks over the life of the project. Literature reviews reveal different terms used by authors to depict the sequential phases of project life cycle. These are: Initiation, Growth, Production and Shut-down (Stuckenbruck, 1981) or Conceptual; Planning; Execution and Termination (Pinto and Prescott, 1988, Pinto and Slevin, 1989, Webster, 1994, and Cleland, 1999), or Selection, Planning, Execution and Termination (Jiang and Heiser, 2004), or Inception, Design, Tender, Construction, and Handover and Closeout (Project Management Institute, 2004) or Defining, Planning, Executing and Delivering (Gray and Larson, 2006). Although there seems to be various terms for the phases of the project life cycle, it basically comprise the initial starting point where the project is defined and planned and gradually being executed and ends upon completion or termination.

According to Bonnal (2002), there are numerous project life-cycle models due to different types and complexity of projects. Stuckenbruck (1981) construct a generic project life cycle phases that could also fit in for construction project by plotting the phases against the total effort to represent the average percentage of time and money as shown in Figure 2.5. The project sequentially goes through the phases or stages where the project effort starts slowly, builds to a peak and then declines when the project is completed and delivered to the owner.

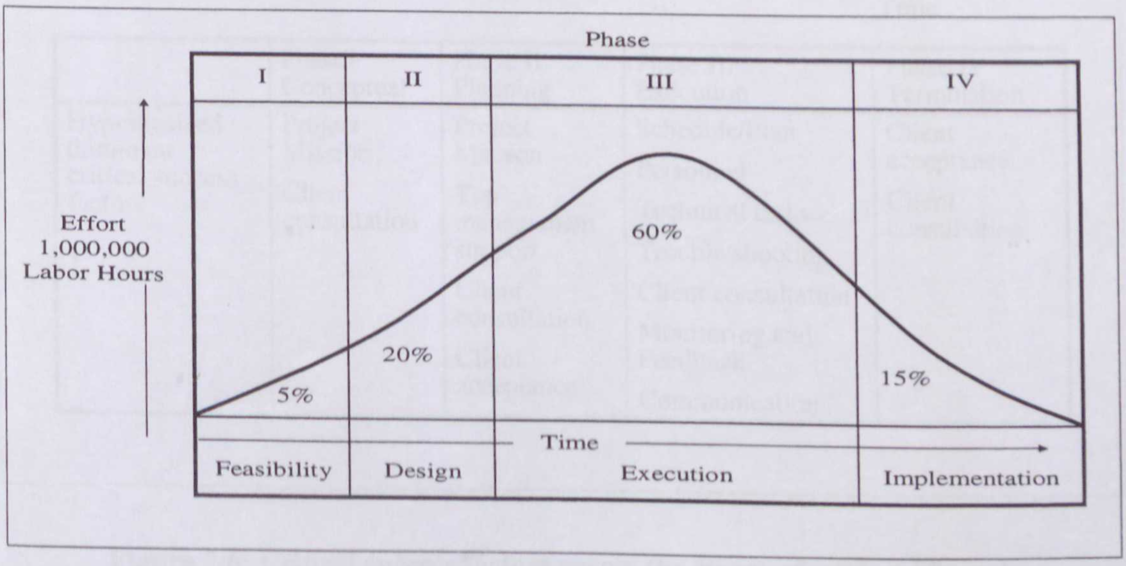
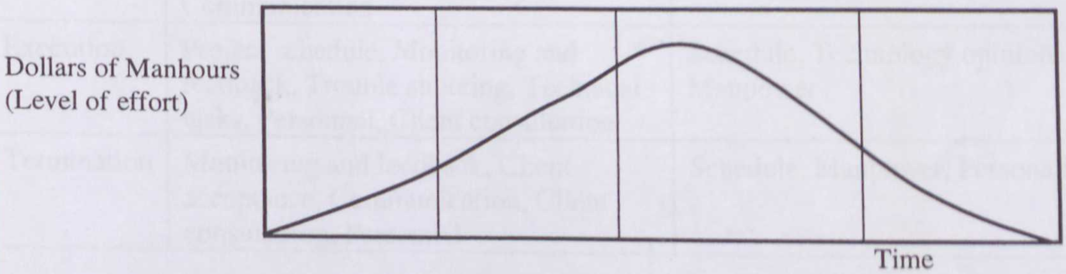


Figure 2.5: Generic model of project life cycle

Source: Stuckenbruck (1981)

2.4.2 Critical success factors over the stages in the project life cycle

There seems to be two different schools of thought regarding critical success factors across the project life cycle. One claims that the critical success factors changes across the project life cycle and the other postulates that the critical success factors are similar and have somewhat similar degree of importance throughout the project life cycle. The result of the study by Pinto and Prescott (1988) indicates that as the project goes through the various phases, the relative importance of the critical factors changes significantly as shown in Figure 2.6. Although the study suggests different critical factors for various phases, it is observed that client consultation is required in all phases of the project life cycle.



	Phase1 Conceptual	Phase II Planning	Phase III Execution	Phase IV Termination
Hypothesized dominant critical success factors	Project Mission Client consultation	Project Mission Top management support Client consultation Client acceptance	Schedule/Plan Personnel Technical tasks Trouble shooting Client consultation Monitoring and Feedback Communication	Client acceptance Client consultation

Figure 2.6: Critical success factors across the stages of project life cycle

Source: Pinto and Prescott (1988)

Studies conducted by Belout and Gauvreau (2004) and Jiang and Heiser (2004) similarly suggest that the factors vary according to the project cycle. The different set of critical success factors across the project life cycle is as shown in Table 2.4. During the selection and planning phases where the concept is outward looking and iterative, the critical success factors are project mission, top management support, schedule and communication. As the project progresses until the completion phases where the concept is sequential, the factors change to soft skills, monitoring, client consultation and acceptance.

Table 2.4: Critical success factors across the project life cycle

Phase	Critical success factors	Probable sources of conflict
Selection	Project mission, Top management support, Project schedule	Project priorities, Administration procedures, Schedule
Planning	Project mission, Top management support, Project schedule, Communication	Project priorities, Schedule, Administration procedure
Execution	Project schedule, Monitoring and feedback, Trouble shooting, Technical tasks, Personnel, Client consultation	Schedule, Technology opinions, Manpower
Termination	Monitoring and feedback, Client acceptance, Communication, Client consultation, Personnel	Schedule, Manpower, Personality

Source: Adapted from Jiang and Heiser (2004)

However, Magal et al (1988) observe that majority of the studies conclude that critical success factors are similar throughout the project life cycle. And applying the same consistent set of factors throughout its life cycle gives the project team a baseline in monitoring the project to achieve its objectives (Rad, 2003). The result from an empirical study by Hartman and Ashrafi (2002) indicate that the critical success factors are required to be in place from the start through the execution phases and there is no significant difference of criticality in different phases.

2.5 PROJECT SUCCESS

2.5.1 Definition of project success

Based on the literature review, it seems that the definition of project success is quite illusive. Numerous authors have researched the subject but the concept of project success remained ambiguously defined. Shenhar et al (1997) note that project success is probably the most frequently discussed topic in the field of project management, yet it is the least agreed upon even though it was for more than two decades, researchers have labored to identify managerial variables critical to success. Although literatures on project success have been of interest to many researches, yet relatively there is little empirical data (Collins and Baccarini, 2004).

Project success is a subjective issue. Wateridge (1995) notes that previous researches appear to have differences in defining project success. In their study, Liu and Walker (1998) state that project success is a commonly discussed topic but rarely being agreed. In an effort to find a generic definition of project success, Baccarini (1999) concludes that literatures on project management do not present a consistent interpretation of the term project success. According to him, a standardized definition of project success, except in quite general terms, does not exist nor is there an accepted methodology of measuring it.

Jugdev and Muller (2005) observe that it is difficult to pin down an exact definition of project success. While others insist that until to-date, project success still remained ambiguously defined (Ashley et al, 1987, Liu and Walker, 1998, Shenhar et al, 2001, Chan et al, 2002, Frigenti and Comninos, 2002, Chan et al, 2004, and Lui, 2004). As such, Prabhakar (2005) concludes that most researchers have agreed to disagree on what constitutes project success.

Apparently determining whether a project is a success or a failure is intricate (Gray, 2001, and Nguyen et al, 2004,) and is complex because it is an abstract concept (Chan et al, 2002). There can be ambiguity in determining and measuring the success or failure of a project. The concept of a project success can mean differently to different people. Due to varying perceptions and perspectives, this led to disagreements whether a project is successful or not (Liu and Walker, 1998, Skulmoski and Hartman, 1999, Gray, 2001, Chan et al, 2002, Rad 2003, and Iyer and Jha, 2005). Shenhar et al (2002) agree that there is no conclusive evidence or consensus that has been achieved so far to determine whether the project is a success or failure.

Delays in completion of projects are common and yet these projects may still be considered as successful. The prestigious Kuala Lumpur International Airport project constructed in 1993 and completed in 1997 had been cited in the Malaysian construction industry as a success but it is several months delayed with millions of contractual claims and variation works. On the other hand, a project that is perceived as a failure by the project team might be perceived as a success by other stakeholders (Rad 2003, Iyer and Jha, 2005). Lim and Mohamed (1999) cited a development for a shopping complex in Kuala Lumpur in 1994. The completion was delayed, construction cost overruned and both the developer and contractor suffered losses and deemed the project has failed. However, the shopping complex was very popular with tenants and shoppers and their perception is different in that the project is a success.

Due to this ambiguity, Pinto and Slevin (1988) used the term perceived success. Whether a project is seen to be a success or a disaster depends on the perspective of different stakeholders (De Witt, 1988, Freeman and Beale, 1992, and Frigenti and Comninos, 2002).

Several authors offer various reasons for this ambiguity. Pinto and Slevin (1988) put forward two reasons. Firstly, it is not clear how to measure project success because the involved parties perceived project success or failure differently and thus they value the outcome differently. Secondly, the lists of success or failure factors vary in various studies and these factors, individually do not affect the project directly. Usually a combination of many factors, at different stages results in project success or failure. De Witt (1988) further suggests that the priorities and objectives of the project by various stakeholders are different throughout the project life cycle. Shenhar et al (2002) postulate three reasons for the ambiguity in most project management studies namely due to the universalistic approach used that assumed all projects are similar, the subjectiveness of the success measures and the limited number of managerial variables examined. Munns and Bjeirmi (1996) submit that this ambiguity will continue to exist if the definition of project success is not made clear.

Historically, studies on project success started in the mid 1900's and its attributes are being equated to cost, time and quality. For over 50 years, project success has been linked to the achievement of the 'Iron Triangle' (Atkinson, 1999, Westerveld, 2003, De Wit,1988, and Dainty et al, 2003). In addition, Belassi and Tukel (1996) observe that the focus of most of the projects since the 1950's is time schedule as they believe that the effect of better scheduling techniques is better management of project resulting in the successful completion of project. This is the traditional and out-dated view (Morris, 2001, Chan et al, 2002, Bryde and Brown, 2004, and Jha and Iyer, 2005). These authors agree that most of the early studies associate project success with time, cost and quality and the project is considered a failure if these elements are not met.

In the 1960's and 1970's the outlook regarding the components of project success began to expand beyond these attributes and into the project management techniques. Rubin and Seeling (1967), quoted by Belassi and Tukel (1996), conduct a study to observe the effect of project manager's experience on the project and used the technical performance as a measure of success. However, this study only emphasizes on one aspect of project management namely the project manager.

Avots (1969) conducted a theoretical study and notes that project management techniques, which has been the predominant operational technique in the aerospace industry, is able to contribute to project success. He reflects that companies that used project management techniques successfully may initially have a competitive advantage over others. Rockart (1979) suggests utilizing the critical success factors that include management techniques and process. De Wit (1988) claims that project success is concerned with project management techniques and control. Liu (2004) observes that studies by others during this period began to focus on organizational management success factors that can be reproduced and applied to other projects.

Then in the 1980s until late 1990s, further studies postulate other dimensions may affect project success. Several authors began to link project success to stakeholders (Cleland, 1988, Pinto and Slevin, 1989, and Wateridge, 1998). De Wit (1988) points out there will be impact on the project success due to the diverse mix of project stakeholders. Belout (1998) proposes that success is the degree of achievement of project objectives measured from stakeholders' viewpoints. Westerveld (2003) discusses on studies conducted in the 1990's that indicate project success as the satisfaction of stakeholders.

At the time, De Wit (1988) seems to make a breakthrough from the standard researches and studies of listing the variables critical to project success. He was among the earliest authors to express 3 different lines of thought to project success: (1) to express the view that there are differences between project management success and project success (2) to construct a project success framework; and (3) to express the view that there are two different components to project success.

The project success framework constructed by De Wit (1988) and as shown in Figure 2.7 take into consideration the stakeholders, project objectives and the management of the project as elements that have an impact on the outcome of project success.

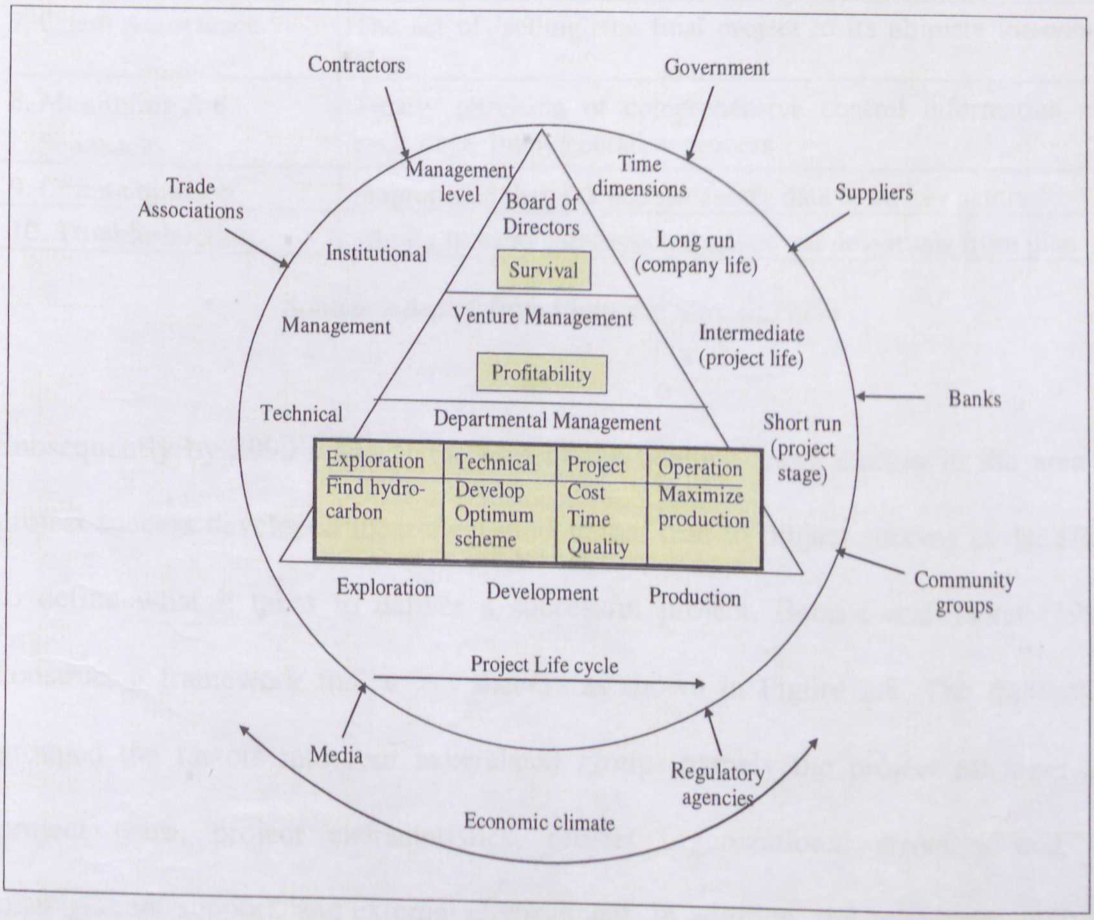


Figure 2.7: Project success framework

Source: De Wit (1988)

Pinto and Slevin (1989) develop ten-factor model critical to project success as shown in Table 2.5. They refer this as the Project Implementation Profile (PIP) that allows the project team to focus on ten human elements and strategic issues of a project.

Table 2.5: Ten-factor model of project success

Success Factors	Description
1. Project Mission	Initial clarity of goals and general directions
2. Top Management Support	Willingness of top management to provide the necessary resources and authority/ power for project success
3. Schedule and Plans	Detailed specification of the action steps required for project implementation
4. Client Consultation	Communication, consultation, and active listening to all impacted parties
5. Personnel	Recruitment, selection and training of necessary personnel for project team
6. Technical Tasks	Availability of required technology and expertise
7. Client Acceptance	The act of 'selling' the final project to its ultimate intended users
8. Monitoring and Feedback	Timely provision of comprehensive control information at each stage implementation process
9. Communication	Appropriate network and necessary data to all key actors
10. Troubleshooting	Ability to handle unexpected crises and deviations from plan

Source: Adapted from Pinto and Slevin (1989)

Subsequently by 1990's and at the turn of the century, more studies in the area of project success developed theoretical models that lead to project success in the effort to define what it takes to deliver a successful project. Belassi and Tukel (1996) construct a framework for project success as shown in Figure 2.8. The framework grouped the factors into four interrelated groups namely the project manager and project team, project characteristics, project organizational structure and top management support, and external environment. In addition, the framework includes the human issue of impact of client, project manager's effectiveness and availability of resources.

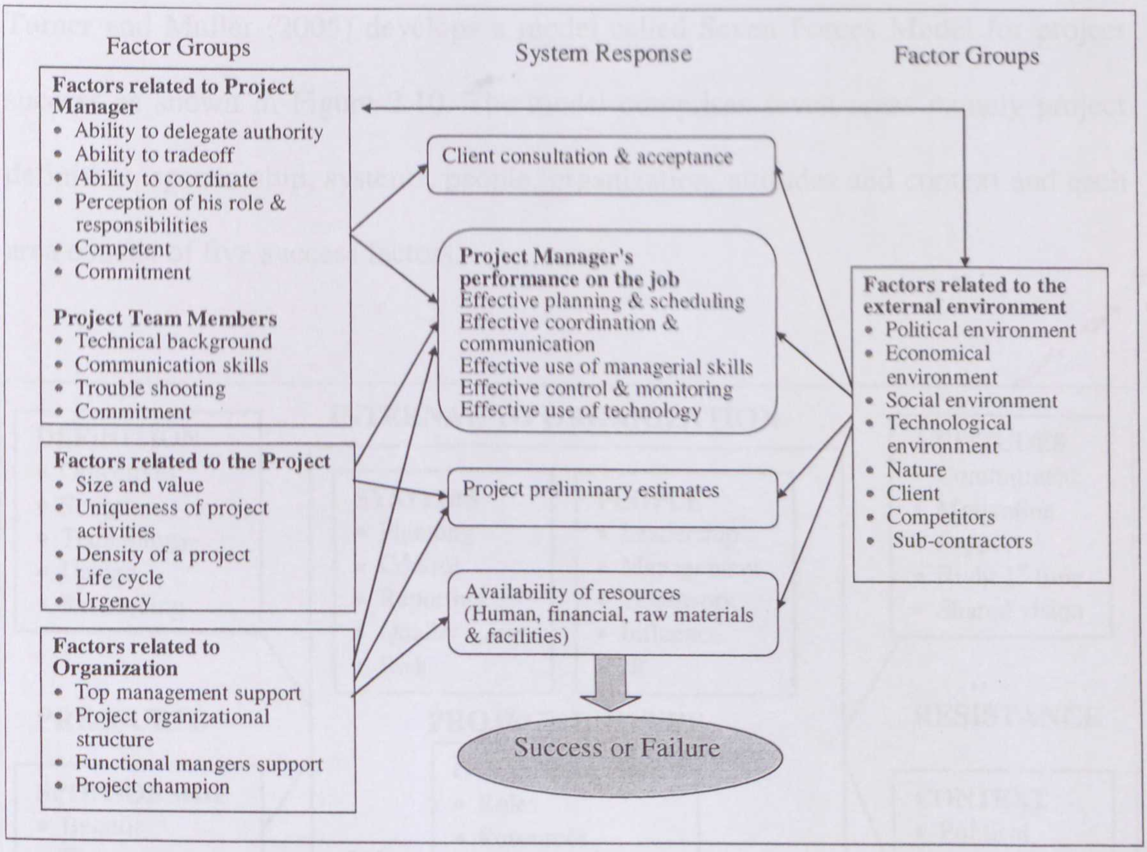


Figure 2.8: The framework of critical success factors and their effect

Source: Belassi W and Tukel (1996)

Liu and Walker (1998) argue that previous studies on project success are overly simplified. They construct what they term as a Behavior-Performance-Outcome model integrating the variables of project success that include goals, behavior, performance, evaluation and outcome as shown in Figure 2.9.

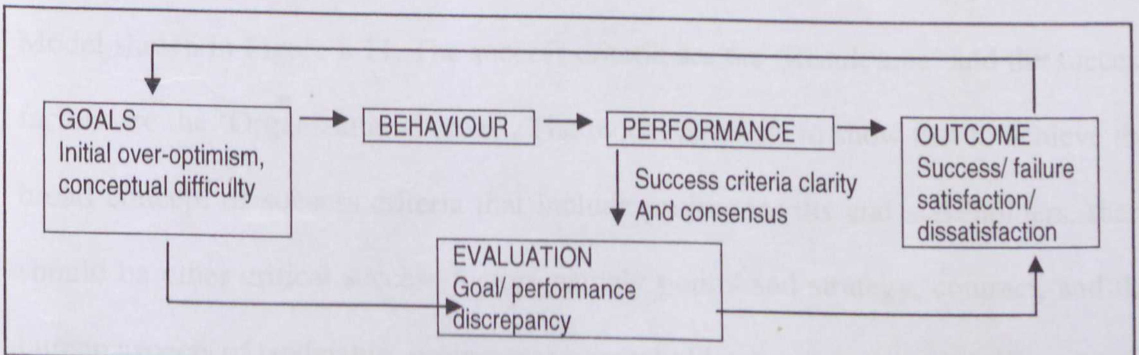


Figure 2.9: Behavior-Performance-Outcome model of project success

Source: Liu and Walker (1998)

Turner and Muller (2005) develops a model called Seven Forces Model for project success as shown in Figure 2.10. The model comprises seven areas namely project definition, sponsorship, systems, people, organization, attitudes and context and each area consist of five success factors.

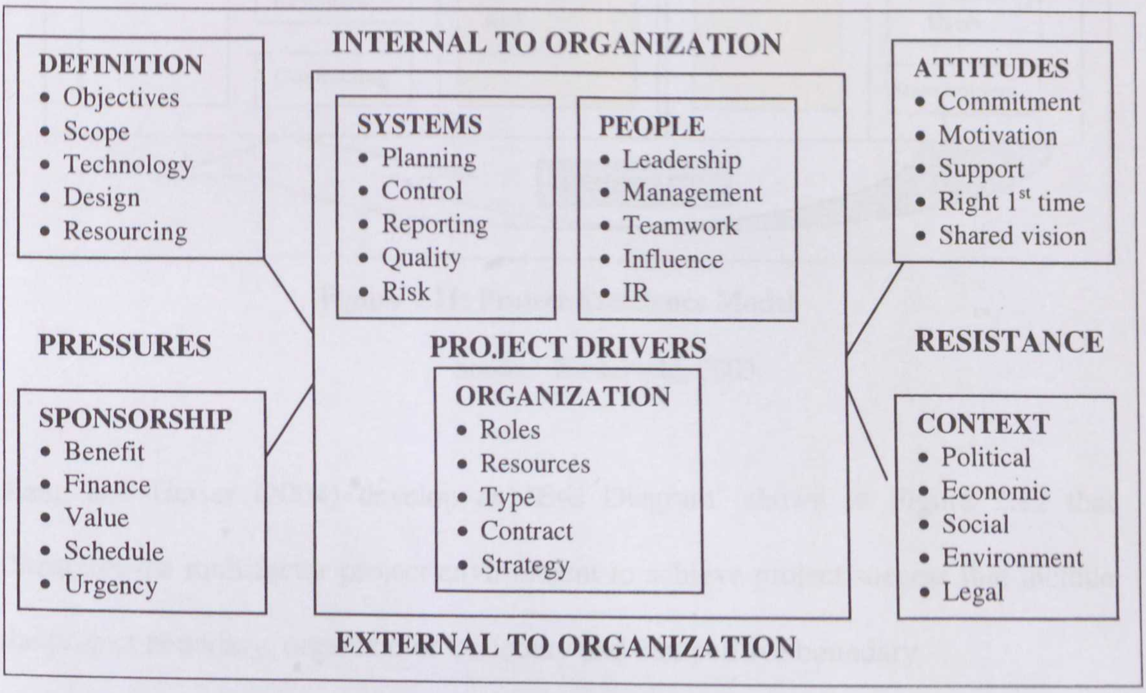


Figure 2.10: The Seven Forces Model for project success, after Turner (1999)

Source: Turner and Muller (2005)

Westerveld (2003) constructs a model that links all the variables of project success, which he demarcates as success criteria and success factors in a Project Excellent Model shown in Figure 2.11. The success criteria are the 'Result area' and the success factors are the 'Organizational areas'. The model attempts to show that to achieve the broad concept of success criteria that include project results and stakeholders, there should be other critical success factors namely policy and strategy, contract, and the human aspects of leadership, project team, stakeholder management, and resources.

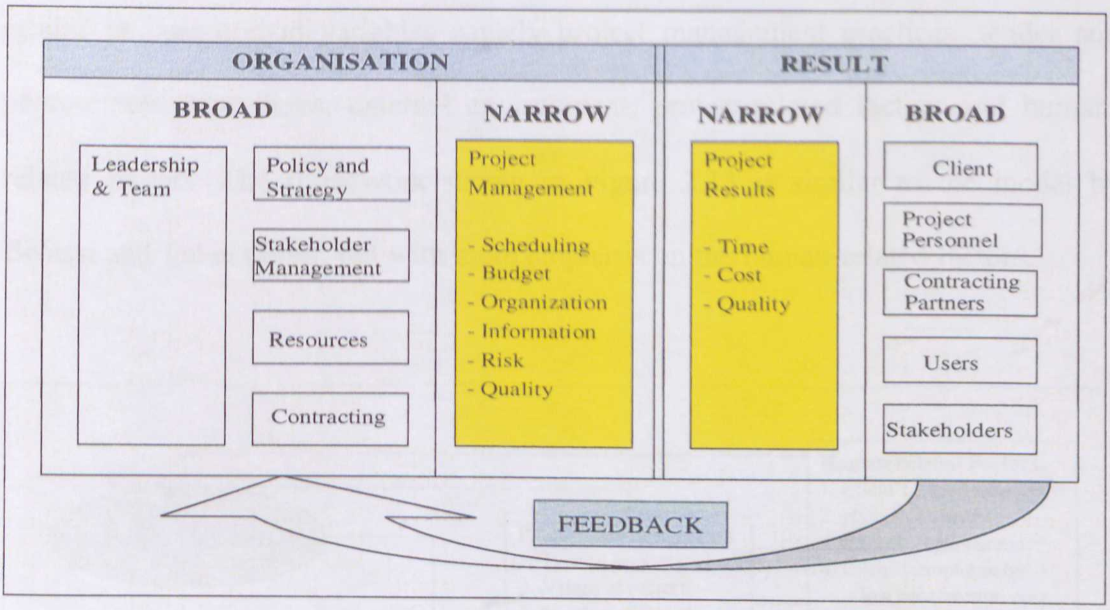


Figure 2.11: Project Excellence Model

Source: Westerveld, 2003

Jiang and Heiser (2004) develop an 'Eye Diagram' shown in Figure 2.12 that illustrates the multifactor project environment to achieve project success that include the project boundary, organization boundary and competitive boundary.

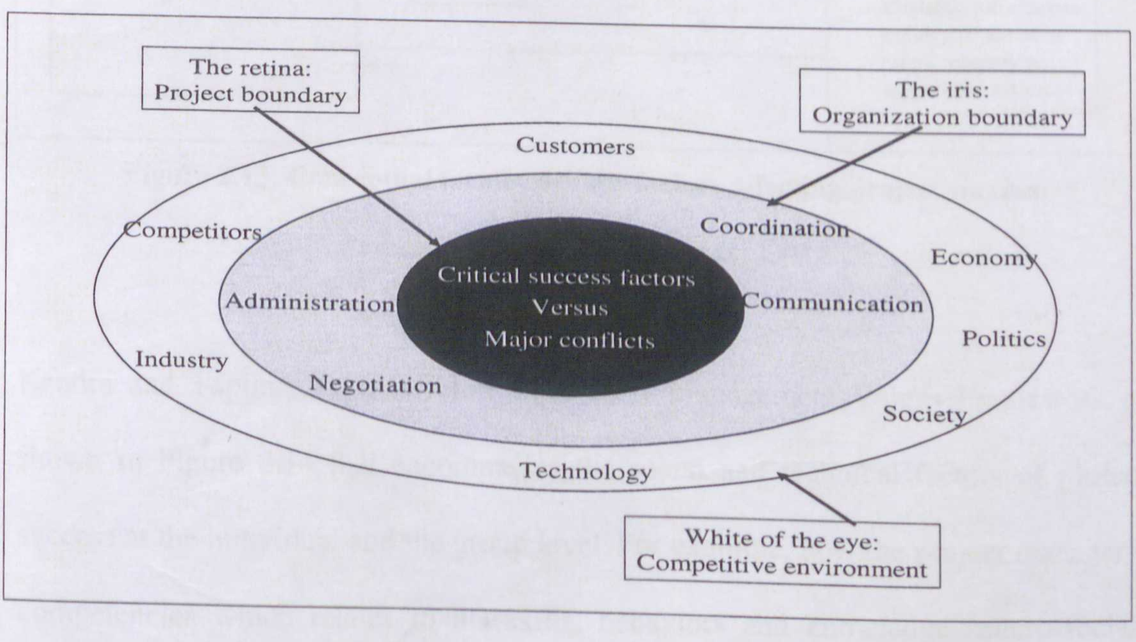


Figure 2.12: The Eye Diagram

Source: Jiang and Heiser (2004)

Another project success framework by Chan et al (2004) categorizes five (5) major groups of independent variables namely project management practices, tender and procurement procedures, external environment, project-related factors and human-related factors. The framework shown in Figure 2.13 is similar to the model by Belassi and Tukel (1996) but with more emphasis on the human-related factors.

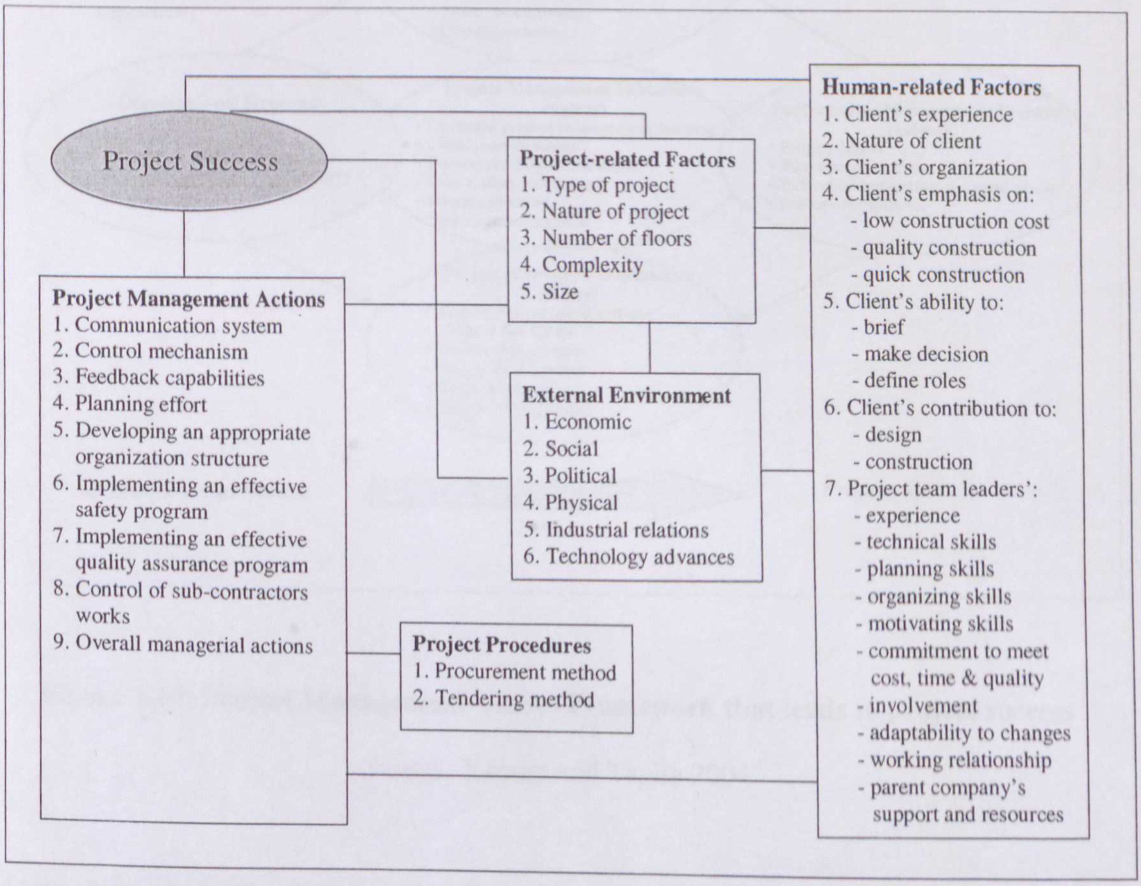


Figure 2.13: Conceptual framework for factors affecting project success

Source: Adapted from Chan et al (2004)

Kendra and Taplin (2004) develop the Project Management Values Framework as shown in Figure 2.14 that encompasses the social and technical factors of project success at the individual and the group level. For example, how the project manager's competencies which relates to his skills, behaviors and knowledge (micro-social) interacts with the social and technical dimension in dealing with the project team members (macro-social) and project activities (macro-technical).

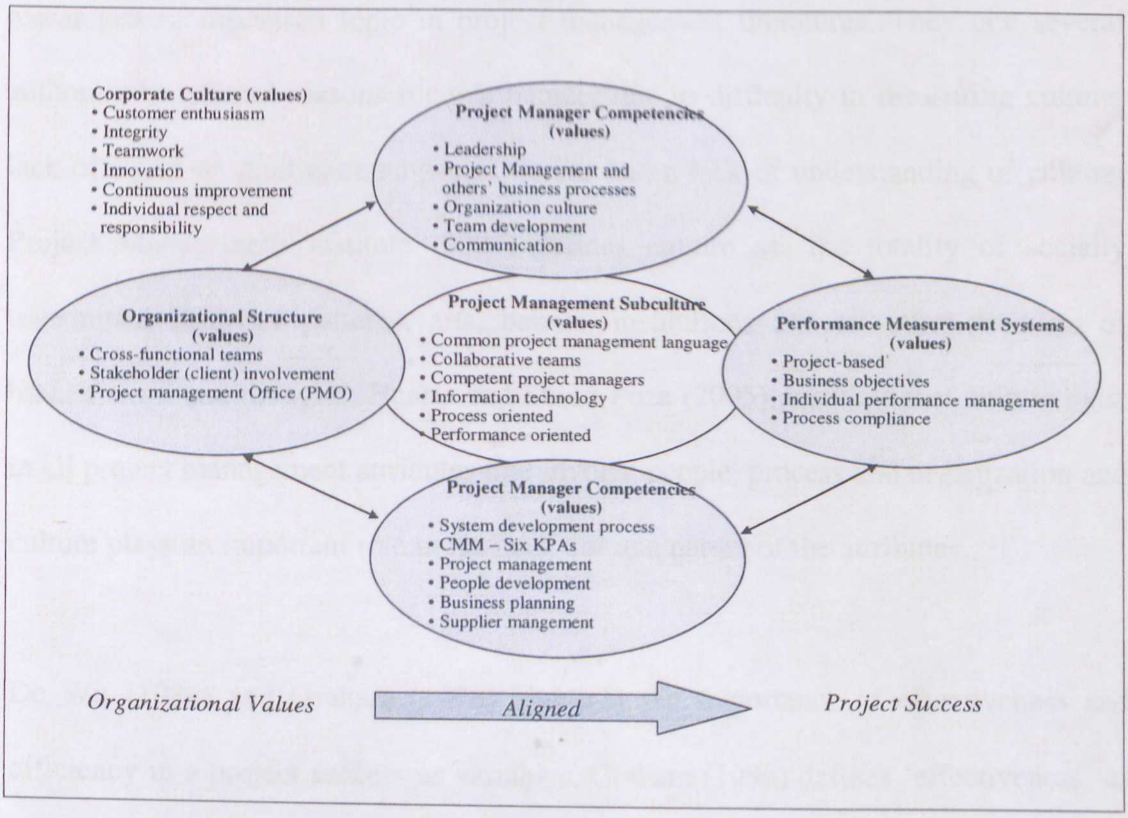


Figure 2.14: Project Management Values Framework that leads to project success

Source: Kendra and Taplin 2004

Apart from project success models, others began to explore general and broad spectrum issues that cut across all boundaries, factors and levels, and this include environment, culture, efficiency and effectiveness. Jugdev and Muller (2005) develop a four-condition requirement as a conducive environment that would encourage project success. These conditions are: (1) Common understanding of success criteria amongst key stakeholders (2) Collaborative working environment amongst project team and between stakeholders (3) Empowerment to managerial personnel, and (4) Interest of the owner on performance of the project.

Henrie and Sousa-Poza (2005) highlight culture as a common theme within the project success factors. However, their study reveals that culture is not a widely researched or discussed topic in project management literatures. They cite several authors who offered reasons for this namely due to difficulty in measuring culture, lack of study on multinational project teams and a lack of understanding of culture. Project Management Institute (2004) defines culture as 'the totality of socially transmitted behavior patterns, arts, beliefs, institutions and all other products of human work and thought'. Henrie and Sousa-Poza (2005) postulate that culture exist in all project management attributes that involve people, process and organization and culture plays an important role in the behavior and nature of the attributes.

De Wit (1988) and Graham (1996) highlight the importance of effectiveness and efficiency in a project success as variables. Graham (1996) defines 'effectiveness' as the measurement on the achievement of project goals and 'efficiency' as the measurement on the percentage of management cost to total project cost. Belout (1998) postulates that project success is consequent to the effectiveness and efficiency of carrying out the project. Brudney and England (1982), quoted by Belout (1998) define efficiency as 'maximization of output for a given level of input or resources' and effectiveness as 'the achievement of goals or objectives'.

In summary, the understanding of project success changes through the years since 1950's until today. The review on the literature captures the changes in the definition of project success into five (5) different periods. Figure 2.15 graphically shows the evolution of the dimensions of project success through and project life cycles adapted from Jugdev and Muller (2005).

PROJECT MANAGEMENT LIFE CYCLE					
PROJECT/ PRODUCT LIFE CYCLE					
CONCEPTION	PLANNING	IMPLEMENTATION	HANDOVER	UTILIZATION	CLOSE-OUT
		Period 1: Time, Cost & Quality (1950's – 1960s)			
	Period 2:Project Management Techniques (1960's – 1970s)				
	Period 3: List of Critical Success Factors (1980's – 1990's)				
Period 4: Project Success Framework/ Models (1990's – 2000)					
Period 5: Project Success Criteria and Project Success Factors (21st Century)					

Figure 2.15: Evolution of project success since 1950's

Source: Adapted from Jugdev and Muller (2005)

2.5.2 Two components of project success

Although over the years, definition of project success has evolved from the simplified achievement of the time-cost-quality objectives to project management techniques and fulfilling stakeholders' requirements and further on with the formulation of sophisticated project success models or frameworks, confusion still seems to exist over the different components of project success. Most project management literature advocate that project success be seen as having two different components. However, the terms used differ.

Several studies, whilst using different terms, accredit project success to two components of project performance namely time, cost and quality; and the human issues namely satisfaction, values and human resources (Sypsomos, 1997, Belout, 1998, Liu and Walker, 1998, Frigenti and Comninos, 2002, Chan et al, 2002, Kerzner, 2002, Kerzner, 2003, Rad and Levin, 2003, and Phua, 2004).

Baccarini (1999) points out that literature often confusingly intertwine two separate dimensions of project success, which he term as product success and project management success. Product success deals with the effects of the project's final product and project management success focuses upon the successful accomplishment of cost, time and quality objectives (Clarke, 1999).

Kendra and Taplin (2004), however, express the two components based on technical and social elements at macro and micro levels. The technical elements are project manager competencies, organizational structure, process and the performance measurement systems. The social elements are the link between these four technical dimensions through the corporate cultures and the project management subcultures. Jugdev and Muller (2005) point out that project success must start at the strategic level of the organization. The variables necessary to ensure project success are conceptualized at the strategic level namely strategically identifying and involving the project manger at the early stage, project goals and objectives and strategic planning. These are then carried out at the operational level.

De Wit (1988) is among the first to propagate that the two components of project success are success criteria and factors. According to him, criteria for success are the project objectives, and the factors are the manner in which these objectives are met. This concept is echoed by subsequent researchers who reiterate the view that the two components to project success are the project success criteria relating to project objectives and the project success factors that are required to deliver those success criteria (Turner, 1994, Wateridge, 1995, Morris, 2001, and Diallo and Thuillier, 2004). Wateridge (1995) states that these two components of project success must be clearly defined, agreed and progressively reviewed by all parties.

However, in reviewing the literature on project success, it seems that there is confusion over the term success criteria and factors as some authors describe them interchangeably as though the variables are synonymous (Lim and Mohamed, 1999). Jha and Iyer (2005) add that there is no consensus among researchers regarding success criteria and success factors. Cooke-Davies (2002) and Collins and Baccarini (2004) stress the importance of differentiating between these two dimensions.

According to Lim and Mohamed (1999), success criteria are "the set of principles, standards or condition" by which judgment is made while success factors are "the set of circumstances, facts or influences which contribute to the result" where it either assist or hinders project success. Figure 2.16 shows the relationship between the success criteria and success factors which contribute to project success.

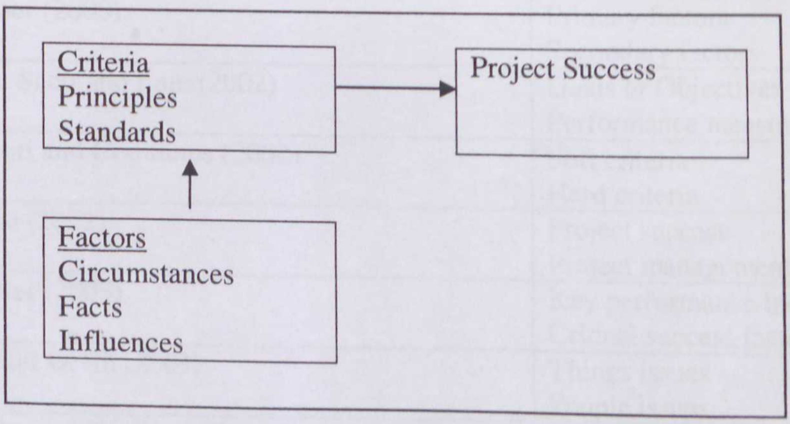


Figure 2.16: Representation of the criteria and factors as applied to project success

Source: Lim and Mohamed (1999)

Cooke-Davies (2002) and Collins and Baccarini (2004) define the success criteria as the benchmark to measure or judge success or failure and success factors are the management inputs and systems that would lead to project success. Westerveld (2003) terms the two components simply as the 'What' and the 'How'. He postulates that for a project to be successful it has to identify and focus firstly, the result areas that is the success criteria which he terms as 'What' and secondly, the organizational areas that is the success factors which he terms as 'How'.

In summary, the two components of project success by various authors are shown in Table 2.6.

Table 2.6: Two components of project success by various authors

	Authors	Components of project success
1	Sypsomos (1997)	Hard measurement Soft factors
2	Belout (1998) and Phua (2004)	Dependent variable Independent variables
3	Liu and Walker (1998)	Project goals Satisfaction of claimant
4	Baccarini (1999)	Product success Project management success
5	Kerzner (2000)	Primary factors Secondary factors
6	Chan, Scott and Lam (2002)	Goals or Objectives Performance measures
7	Frigenti and Comninos (2002)	Soft criteria Hard criteria
8	Clarke (2002)	Project success Project management success
9	Kerzner (2003)	Key performance indicators Critical success factors
10	Rad and Levin (2003)	Things issues People issues
11	Kendra and Taplin (2004)	Social elements Technical elements
13	Jugdev and Muller (2005)	Strategic Operational
14	De Wit (1988), Turner (1994), Wateridge (1995) Morris (2001), Lim and Mohamed (1999), Cooke-Davies (2002), Westerveld (2003), Nguyen et al (2004), Collins and Baccarini (2004), Kin (2004), and Diallo and Thuillier (2004)	Project success criteria Project success factors

Source: Various authors as stated

In this study, the findings of researches on project success are categorized according to two components namely, success criteria ('What') and success factors ('How'). These two categories are as advocated by the numerous authors as stated in Table 2.6. Based on this concept, the components of project success used in this study are shown graphically in Figure 2.17.

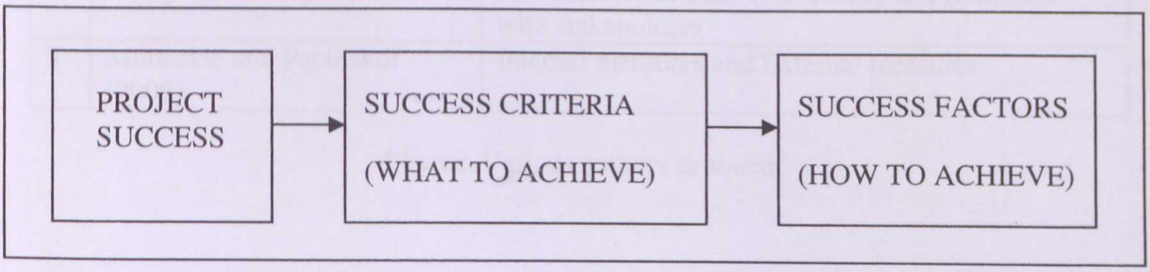


Figure 2.17: 'WHAT' and 'HOW' of project success

2.6 SUCCESS CRITERIA ('WHAT')

2.6.1 Definition of success criteria

Success criteria relate to users and sponsors (Wateridge, 1995). These are the set of principles, standards, level of performance, dimensions or determinants by which judgment is made on the project (Lim and Mohamed, 1999, Rad, 2003, Nguyen et al, 2004, Phua, 2004, and Diallo and Thuillier, 2005). These criteria became the benchmark to measure success or failure (Cooke-Davies, 2002, Collins and Baccarini, 2004, and Diallo and Thuillier, 2005). In brief, success criteria are the result area of what are to be achieved thus termed 'What' (Westerveld 2003). It is the criteria used to assess project success. Table 2.7 shows different categorization of success criteria by various authors.

Table 2.7: Categorization of success criteria by various authors

	Authors	Categorization
1	Wateridge (1995)	Project objectives of time-cost-quality and Objectives of stakeholders
2	Lim and Mohammed (1999)	Macro criteria and Micro criteria
3	Chua, Kog and Loh (1999)	Major goals and Other specific objectives
4	Chan, Scott and Lam (2002)	Objective, hard, tangible, measurable criteria and Subjective, soft, intangible. less measurable criteria
5	Rad and Levin (2003)	Things-related attributes and People-related attributes
6	Westerveld (2003)	Project results and Appreciations by stakeholders
7	Wang and Huang (2005)	Performance of time-cost-quality and Relations with stakeholders
8	Milosevic and Patanakul (2005)	Internal measures and External measures

Source: Various authors as stated

Table 2.7 shows that most of the authors classify the success criteria into two main categories. The difference is the terms used to categorize the success criteria. The first criterion is regarding the achievement of objectives or results that relate to time, cost and quality. The second criterion is the achievement of other objectives that include what the project accomplishes in terms of appreciation and satisfaction. Based on this concept, success criteria used in this study comprise the achievement of time, cost and quality and the achievement of stakeholders' appreciation as shown in Table 2.8. The success criteria that affect the project success identified by various authors are tabulated in Appendix 1.

Table 2.8: 'WHAT'/ Criteria of project success

SUCCESS CRITERIA (WHAT TO ACHIEVE)
• Completes within Time • Completes within Cost • Meets required Quality • Stakeholders' appreciation

2.6.2 Time, cost and quality

Launi (1999) challenges the project triangle and introduces what he terms the Project Diamond adding in the element of 'Scope', but other authors maintain the time-cost-quality triangle with the element of scope within the quality. A study by White and Fortune (2002) establish that although there may be other criteria but those are minor in nature and reiterate that time-cost-quality are the main success criteria. Westerveld (2003) concurs with the contention stating that generally, all projects will define their own project success criteria or results based on the time, cost and quality constraints.

Lai (1997) states that when the various tools and techniques of project management are properly applied, these will contribute to lower cost, speedy delivery and project of quality. The various tools and techniques available are as shown in Figure 2.18.

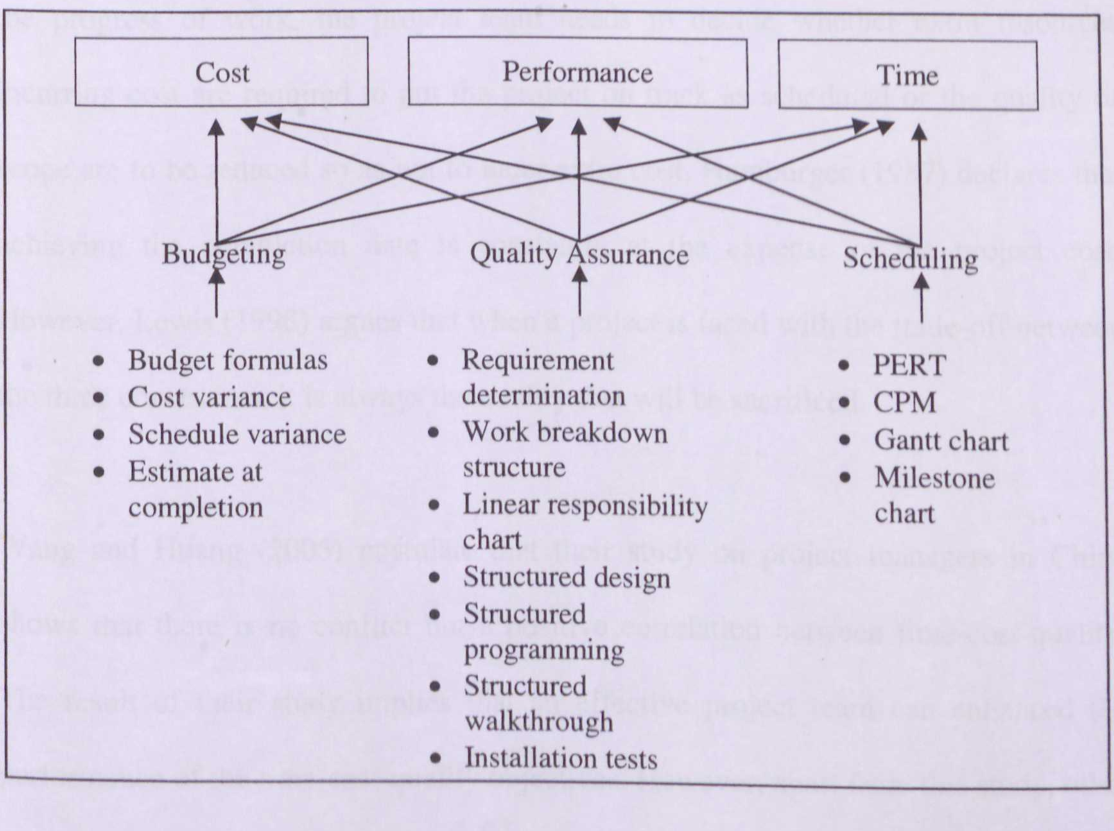


Figure 2.18: Tools and techniques to optimize performance, time and cost

Source: Lai (1997)

Project management literature has been emphasizing on conflicting objectives or competing demands of time-cost-quality and trade-offs between these objectives (Skulmoski and Hartman, 1999, Angelides, 1999, Project Management Institute, 2004, and Wang and Huang, 2005). Rosenau (1981) terms the time-cost-quality objectives as the 'Triple Constraint' and the difficulty in achieving all the three constraints, which are pulling at different directions on the same limited resources. Petersen and Murphree (2004) note that the most difficult part of managing a project is trying to balance delicately the conflicting project objectives of time-cost-quality to produce project success.

Lai (1997), Skulmoski and Hartman (1999), and Volckmann and Knutson (2001) highlight the trade-offs between the time-cost-quality objectives noting that sacrificing one condition will affect the other two conditions. In the event of delay in the progress of work, the project team needs to decide whether extra resources incurring cost are required to put the project on track as scheduled or the quality or scope are to be reduced so as not to incur extra cost. Hamburger (1987) declares that achieving the completion date is constantly at the expense of the project cost. However, Lewis (1998) argues that when a project is faced with the trade-off between the three constraints, it is always the quality that will be sacrificed.

Wang and Huang (2005) postulate that their study on project managers in China shows that there is no conflict but a positive correlation between time-cost-quality. The result of their study implies that an effective project team can enhanced the performance of the time-cost-quality objectives. However, apart from this study, other literatures conclude there exist conflict in the time-cost-quality objectives.

The key stakeholders need to agree on the ranking or relative importance of the success criteria of time, cost and quality at the onset of the project (Wateridge, 1995, and Skulmoski and Hartman, 1999). This is to avoid large divergence on the perception of the constraint between the stakeholders. In fact, one of the main duties of key stakeholders and project manager is not merely to balance but to prioritize the competing objectives of time, cost and quality (Goldbold, 2003, and Abu Bakar, 2006).

Skulmoski and Hartman (1999) consider the 'Priority Triangle' as a tool to determine which of the project constraints of time-cost-quality as the most critical to project success. The key stakeholders are required to prioritize the project constraints as a guide to the project team. Figure 2.19 is an example where cost is decided as the priority, indicated by the inverted time-cost-quality triangle with the cost at the bottom to symbolize minimizing the cost and the relevant quadrant marked 'X'. The figure shows a representation of boundaries that key stakeholders had identify on the onset of the project of what will not be compromised, as it would affect stakeholder satisfaction. The project team can then use this priority triangle to base their decision, which indicates the criticality of cost, followed by time, while sacrificing the quality.

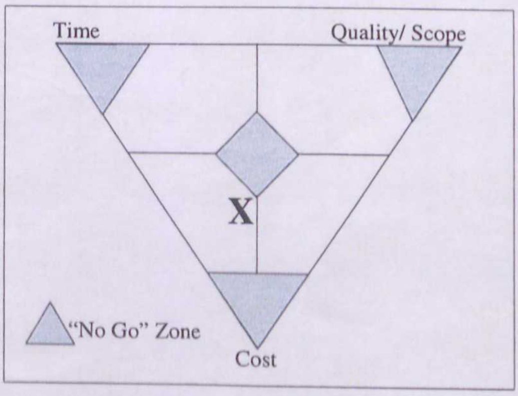


Figure 2.19: Priority triangle

Source: Skulmoski and Hartman (1999)

(a) Time

Most authors as shown in Appendix 1 agree that the term 'Time' or sometimes referred to as 'Schedule' simply means that the project completed on or before the date of completion. Others refer to it as within the project duration (Steyn, 2002, and Chan and Chang, 2004), allocated duration (Chan et al, 2002) or completion on schedule (Songer and Molenaar, 1997, and Hatush and Skitmore, 1997a). Goldratt (1997) and Steyn (2002) claim that time or the project duration is the critical constraint and effort and attention should be limited to project time management. Chan (1997) postulates that time can be measured by construction time, speed of construction and time variation. He defines construction time as the absolute time to complete the project, speed of construction as the relative time measured per gross floor area, and time variation as measured by the percentage increase or decrease of the construction time.

(b) Cost

Most authors as shown in Appendix 1 agree that the term 'Cost' or sometimes referred to as 'Budget' simply means that the project completed within the approved cost or estimated budget. Hatush and Skitmore (1997a) refer to it as getting value for money. According to a study by Gibb and Isack (2001), the two preferred definitions for value for money are lowest whole-life cost and lowest cost for given quality. Cost can be measured by unit cost and cost overrun (Chan and Chang, 2004), lower unit cost (Chan, Scott and Lam, 2002) and minimizing cost (Ling, 2004). Chan and Chang (2004) define unit cost as the contract sum per gross floor area and cost overrun as percentage net variation over final cost.

(c) Quality

The term 'Quality' is typically defined along certain dimensions as postulated by most of the authors in Appendix 1. These include high quality workmanship, attaining the required safety and health, no major accidents, performance, functionality or fitness for purpose, minimum changes or scope creep, features and aesthetic or appearance.

Quality was traditionally perceived as having a high level of goodness or luxury, intangible and is not measurable (Angelides, 1999). This definition is outdated as quality is defined as 'the degree to which a set of inherent characteristics fulfils requirements (International Standard ISO 9000, 2000). British Standard Institute (1991) in BS 5750 Quality systems defines quality as 'the totality of features required by a product or service to satisfy a given need'. Nokes and Kelly (2007) simply describe quality as 'conformity to requirements'.

This 'given need or requirement' may be as provided in the technical specifications and customer satisfaction as required by the client (Hopkins et al, 2004). Thus, according to Campbell and Baker (2007) the starting point is to ascertain these requirements or standards relevant to the project. The standard or level of quality needs to be agreed with the client (Angelides, 1999) or the involved stakeholders that include not only the client but also including the consultant, contractor, entrepreneur, supplier and governing body (Berawi, 2004). In addition, Angelides (1999) postulates that conformance to this standard of quality means that the product complies with the said requirements.

According to Heisler (1990), although certain elements of quality can be quantified and measured fairly accurately, there are other subjective elements that he terms as 'operational and functional compliance' that are more difficult to quantify and measure. These are, amongst others, client's perception on performance, reduced maintenance, ease of maintainability and avoidance of premature equipment failure. Similarly Arditi and Gunaydin (1997) point out the difference between 'quality in fact' where the quality meets the required specification but fails due to 'quality in perception' where even if it is of high quality it does not meet the needs of the stakeholders. Angelides (1999) claims that it is outdated to state that the quality is achieved if it conforms to the specification limits as quality should be considered upon achieving the key stakeholders' requirements.

2.6.3 Stakeholders' appreciation

The term 'Stakeholders' appreciation' can be measured by several elements as postulated by the authors in Appendix 1:

- Key stakeholders
- Satisfaction of stakeholders
- Conform to stakeholders' expectations and benefits
- Profitability, yield business or other benefits
- Absence of conflict
- Good relationship with stakeholders

In any project, there will be different project stakeholders or contributors that must be identified and acknowledged. It is of paramount importance that the project manager or project leader be aware of all the stakeholders in their project and their objectives as this criterion is vital to project success (De Wit, 1988, McElroy and Mills, 2003, Crawford and Pollack, 2004, and Olander and Landin, 2005).

Project stakeholders are parties that have a stake in the project (De Wit, 1988), and who will be affected by the project (Chan et al, 2002). The two obvious main stakeholders to any project are the client and the contractor or builder (De Wit, 1988, and Chan et al, 2002). Apart from them, Wang and Huang (2005) and Chan et al (2002) identify the third main stakeholder as the independent professional third party responsible for supervising the project namely the architect, surveyor, and engineer. Others include the government, public authorities, local politicians, environmental groups and even the public within the definition of stakeholders (De Witt, 1988, Barnes and Wearne, 1993, and McElroy and Mills, 2003). Westerveld (2003) differentiates stakeholders into five categories namely the client, project personnel, users, contracting partners and others who have an interest in the project.

Diallo and Thuillier (2004) note that in the African context of international projects, there are seven stakeholders namely the coordinator, task manager, national supervisor, project team including the design consultants, steering committee, beneficiaries or client and the population at large benefiting from the project.

It seems that there are potentially many groups within the definition of project stakeholders. As such, Neal (1995) and McElroy and Mills (2003) suggest that the project manager need to identify and focus on only the key stakeholders. Key stakeholders are individuals and organizations who are actively involved in the project, who have vested interest and will be affected by the implementation of the project and who have and may influence the outcome of the project (McElroy and Mills, 2003, and Heldman et al, 2007). These key stakeholders are the client who initiate and the end-user who will be using the end product, the project manager who is responsible for managing the project and project team members who perform the work of the project, and lastly the sponsor who provide the financial resources.

Most authors in Appendix 1 agree that the term 'Stakeholders' appreciation' simply means that the project conform to stakeholders' expectation or has acquired the satisfaction of the key stakeholders. Chan et al (2002) describe satisfaction as 'the level of happiness of people affected by the project'. Satisfaction of the client is not merely attaining the project goals but including active co-operation, participation and commitments amongst project participants (Leung et al, 2004). In fact, according to Graham (2003), and Kamara et al (2000) satisfying stakeholders is the raison d'être of any project. Westerveld (2003) tabulated the level of appreciation by various stakeholders as shown in Table 2.9.

Table 2.9: Explanation of appreciation by stakeholders

	Result area	Explanation
A	Appreciation by the client	The client initiates the project to fulfill a specific need. What aspects and factors does the client value in judging the success of the project.
B	Appreciation by project personnel	The workers of the project will be concerned with reaching their personal goals as well as a good working atmosphere.
C	Appreciation by users	Users are concerned with their overall influence in the project and the functionality of the end product.
D	Appreciation by contracting partners	Contracting partners try to make a profit at the project. They are also concerned with getting new orders and learning possibilities.
E	Appreciation by other stakeholders	Those parties that are not directly involved in the project but have a large influence. E.g. environmental groups, citizens and government agencies. These parties manage their specific interest.

Source: Adapted from Westerveld (2003)

Chen and Partington (2004) state that in China, relationship is considered very important and the clients are the 'boss' of the project and working and personal relations must be established so as to make the client happy. Wang and Huang (2005) describe this relationship as 'quanxi' and define it as 'special relations or particularistic ties between people'. Their study on critical success criteria reveals that if their 'quanxi' performance with the key stakeholders is good, even though the time, cost and quality performed below the project plan baselines, the project is considered a success.

Each of these stakeholders comes with their own objectives and expectations, which could often be conflicting (Cherns and Bryant, 1984, and De Wit, 1988). Due to this, Wateridge (1995) suggests that prior to the implementation of a project the stakeholders should have a common view and understanding of the project's success criteria that shall be reviewed and agreed at regular intervals.

Skulmoski and Hartman (1999) coined the word 'Project Alignment' for successful project implementation. According to them not only should all the key stakeholders share a common understanding of the project's mission, goals, objectives, tactics and plan but their own expectations and objectives should also be aligned with the project's. Thus, the achievement of personal success becomes a powerful motivator for project success. However based on a study by Hartman and Ashrafi (2004) there is a lack of alignment on success criteria among the stakeholders.

2.7 SUCCESS FACTORS ('HOW')

2.7.1 Definition of success factors

Success factors are those elements that are required to deliver the success criteria (Wateridge, 1995). These elements are the set of circumstances, forces, facts or influences, (Lim and Mohamed, 1999), management inputs and system (Cooke-Davies, 2002), levers (Westerveld, 2003), essential activities (Kanter and Walsh, 2004), and key variables (Diallo and Thuillier, 2004). These also include knowledge, skill, trait, motive, attitude, value or other personal characteristics essential to perform the required task (Nguyen et al, 2004). They contribute to the result or the achievement of the success criteria (Lim and Mohamed, 1999) and increase the likelihood of project success (Westerveld, 2003) as they are the key determinants of project success (Kanter and Walsh, 2004). According to Lim and Mohamed (1999), these success factors influence project success but it is not the basis of measurement or judgment. In brief, success factors are the organizational areas of how to achieve the success criteria thus termed "How" (Westerveld 2003). It is the factors to achieve the project success criteria.

The project success factors identified by various authors are as mentioned in paragraph 2.5.1 that include authors who attempt to define project success and studies that formulated project success models, and in paragraph 2.8.2 that include studies on the ranking of success factors. The list of all the success factors by these various authors are compiled and tabulated in Appendix 2. In summary, the project success factors are shown in Table 2.10. Subsequently these project success factors are reduced using factor analysis as described in detail in Chapter 4 where only eighteen (18) success factors that are relatively more significant are selected for further analysis.

Table 2.10: Project success factors

PROJECT SUCCESS FACTORS	
1. Attitude, behavior and commitment	18. Performance, effectiveness and efficiency
2. Client consultation and acceptance	19. Planning
3. Contracting	20. Policy and strategy
4. Contractor	21. Project manager
5. Communication	22. Project characteristic
6. Culture	23. Project definition
7. Design	24. Quality management
8. Documentation	25. Resources and personnel
9. Empowerment	26. Risk management
10. Estimate	27. Safety program
11. External environment	28. Schedule
12. Financial resources	29. Stakeholder management
13. Goal/ objective and mission	30. Team and leadership
14. Innovation	31. Technical
15. Learning organization	32. Top management support
16. Monitoring and control	33. Troubleshooting
17. Organization structure	

2.7.2 Success factor groups

Various researches claim that instead of analyzing individual factors affecting the outcome of the project, these success factors should be classified or grouped, as their combined effects would eventually lead to either the success or failure of the project (Schultz et al, 1987, Clarke, 1999, and Bryde and Brown, 2004). Nguyen et al (2004) postulate that the grouping of success factors should not be too general, too specific or too technical. The classification or grouping of success factors postulated by various authors is as shown in Appendix 3. Based on the concept advocated by these authors, this study classifies success factors into groups. The grouping is based on the management philosophy that would enable the stakeholders of the construction industry to relate to the managerial aspect of their organization.

Literature review on general management and project management reveals four (4) common and frequently mentioned issues namely people or human, process, organization, and contract and technical. People, process and organization are amongst the main principle of management, whilst contract and technical take into cognizance the quintessence of the construction industry. As such this study classifies or groups success factors based on the proceeding literature review and these groupings are 'Human management', 'Process', 'Organization' and 'Contract and technical' as shown in Table 2.11.

SUCCESS FACTORS (HOW TO ACHIEVE)
• Human management • Process • Organization • Contract and technical

Table 2.11: Factors of project success/ 'HOW'

The subsequent review is a compilation of literatures emphasizing the frequently mentioned issues of human, process, organization, and contract and technical.

The common dimensions for best practice in project management include people, process and organization (Slevin and Pinto, 1987, Newcombe 2000, Duggan and Blayden, 2001, Morris, 2001, Jugdev and Thomas, 2002, Westerveld, 2003, Campobasso and Hosking, 2004, and Jiang Heiser, 2004). Zobel and Wearne (2000) note that the common topics, highlighting importance, in conferences on project management were on human issues, soft skills, and project organization. In addition, articles on construction projects emphasized on contract and technical aspects.

Thierauf et al (1977) describe the 'Management Theory Jungle' in a chronological list as shown in Table 2.12. It summarizes the principles from the various management theories, where the common themes are people or human elements, organization, and process.

Table 2.12: Summary of management principles

Management theory	Authors	Principles
Scientific Management	Taylor, Gantt, Gilbreth	Organization, Process, Productivity, and Mechanization
Functional Management	Fayol	Organization, Process, and Functions
Human Relations Movement	Mayo, Roethlisberger	People (Psychological needs)
Behavioral Science	Maslow, McGregor	Human needs (Motivation & Leadership)
Quantitative Approach	Morse and Kimball, McCloskey and Trefetken,	Process and Operations
Systems Approach	Ludwig von Bertalnffy, Kenneth Bouding,	Process and Systems
Contingency Approach	Kast, Rosenzweig	Organization and Human behavior (leadership & Situational approach)

Source: Adapted from Thierauf, Klekamp and Geeding (1977)

Collis and Montgomery (1977) put forward a framework for corporate strategy as shown in Figure 2.20. The strategy to achieve corporate advantage also includes the elements of human resources, processes, and organizational structure.

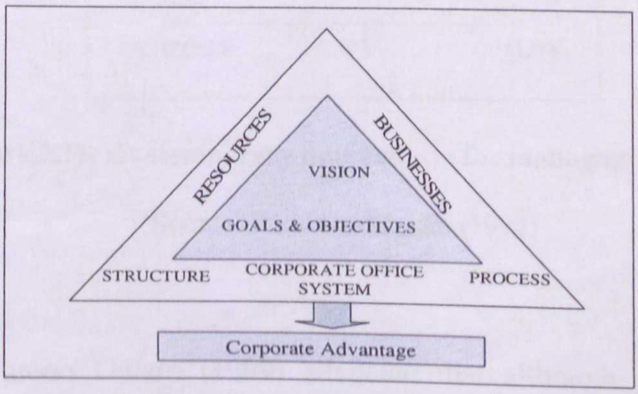


Figure 2.20: The Triangle of corporate strategy

Source: Collis and Montgomery (1977)

Many researchers agree on the vital factor of the human function in the success of an organization (Belout, 1998, Cooke-Davies, 2002, Clarke, 2002, and Cooke-Davies and Arzymanow, 2003). Even in construction projects good human relations are vital in ensuring success of the project implemented (Ritz, 1994). Morris and Pinto (2004) observe that the subject of the 'people side of project management' began to be given more and more emphasis. After the 1960s, studies on the people aspect of the project management became more prominent and significant (Sotiriou and Wittmer, 2001). A study by Belout and Gauvreau (2004) establishes a direct correlation on personnel or human factor amongst the various independent variables and project success. In fact, Henrie and Sousa-Poza (2005) observe that the element of people seems to be a common theme in studies regarding project success and project failure.

Accordingly Kleim and Ludin (1992) claim that the Iron Triangle is not complete and should be as shown in Figure 2.21 to include the element of people.

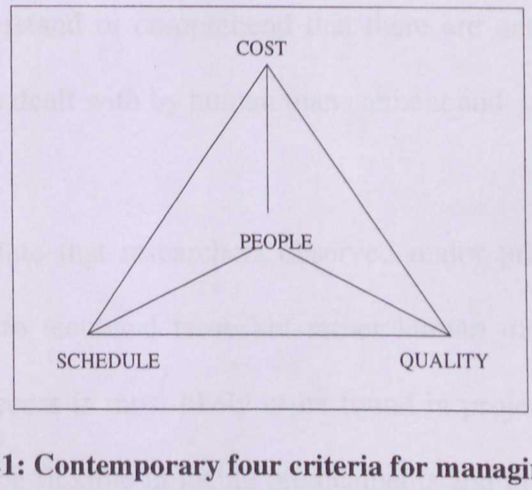


Figure 2.21: Contemporary four criteria for managing projects

Source: Kleim and Ludin (1992)

Bubshait and Farooq Gulam (1999) advocate that although project management concepts, tools and techniques are important in the implementation of project, the main factor or true secret is the often-overlooked human management. Henrie and Sousa-Poza (2005) highlight that even with the best project management techniques and processes but if the people involved misused or inadequately applied them the project will not be successfully managed. To ensure success, it is the people factor using the firms' tools of the trade (Gray and Lawson, 2002). Cooke-Davies (2002) and Clarke (2002) reiterate the importance of human management suggesting that the human dimensions exist in all success factors and 'the people side of the success factors is woven into their very fabric'. They state that it is the people who determine the adequacy of any process.

Belout (1998) states that it is the flexibility and discretion of the human element that is vital in interpreting the circumstances and situation even though there exist processes and procedures. Levine (2002) observes that many project managers have the tendency to standardized project management processes and deal with works operations with an automation-like approach. According to him, these project managers fail to understand or comprehend that there are uncertainties and risks in projects that should be dealt with by human management and judgment.

Slevin et al (2002) state that researchers observed major problems in construction projects are not due to technical issue but rather human management issue. They reveal that project success is most likely to be found in projects that amongst others possess the ability to be flexible in facing predicaments and problems. This flexibility could only be possible by human involvement and intervention. Cooke-Davies and Arzymanow (2003) agree as they state that the human dimension to project management is the people and the application of the expertise, knowledge and judgment of the people make the difference.

Many researchers postulate that process is fundamental to project management because it not only create project product but also organize the necessary strategy and tasks that create that product (Thierauf et al, 1977, Kuprenas et al, 2000, Abdomerovic and Blakemore, 2002, Yeo, 2002, Clarke, 2002, Kenny, 2003, and Cooke-Davies and Arzymanow, 2003). Abdomerovic and Blakemore (2002) define process as 'a planned series of actions or operations which advances a material or procedure from one stage of completion to another'. They conclude that understanding and applying the interaction of the processes can improve the achievement of time cost and quality.

Project Management Institute (2004) seems to be the main advocate of process. It states that a project manager is required to possess and utilize the nine knowledge areas to properly manage all the sub-processes that are grouped into five main processes of initiating, planning, executing, controlling and closing. Rose (2005) reiterates that most project management body of knowledge would not be as significant if one does not know how to apply them in managing the projects through these five process groups.

According to Ibbs and Reginato (2002) there is a cyclic relation between successful projects and good processes. They equate having good processes to the end product of a successful project and this will in turn benefit other future projects. Jugdev (2004) explores the strategic asset and the processes used by companies to sustain their competitive advantage. She postulates that the formal processes as one of the unique strategic assets to the firm that contribute to the firm achieving and sustaining competitive advantage.

Many researchers postulate that establishing a strong organization is the foundation of a business or project (Avots, 1969, Kometa et al, 1994, Pinto and Slevin, 1994, Brown and Adams, 2000, Kamara et al, 2000, Westerveld, 2003, Boddy and Paton, 2004, Tan, 2004a). Brown and Adams (2000) observe the importance of establishing an organizational structure that would ensure the project to be managed to achieve its agreed objectives. In addition, Westerveld (2003) reviews the findings of previous studies regarding project success and postulates that one of the dimensions of project success is the organizational elements.

Contracting and technical elements of any project establish the contractual framework and scope of work required which are important variables that would affect the performance of the project (Bently and Raffety, 1992, Ritz, 1994, Tan, 1996, Hatush and Skitmore, 1997a, Hashim, 1999, Kartam, 2000, Bower et al, 2002, Zaghloul et al, 2003, Westerveld, 2003, Haapio, 2004, Jha and Iyer, 2005). Slevin and Pinto (1987), Cooke-Davies and Arzymanow (2003), and Jiang and Heiser (2004) observe that managing projects requires special attention to technical factors or dimensions.

Based on the above literature review, the four common or general factors essential in management and the implementation of construction projects are summarized as human management, process, organization, and contract and technical. Figure 2.22 integrate the two components of project success namely success criteria of time, cost, quality and stakeholders' appreciation, and the success factors of human management, process, organization, and contract and technical.

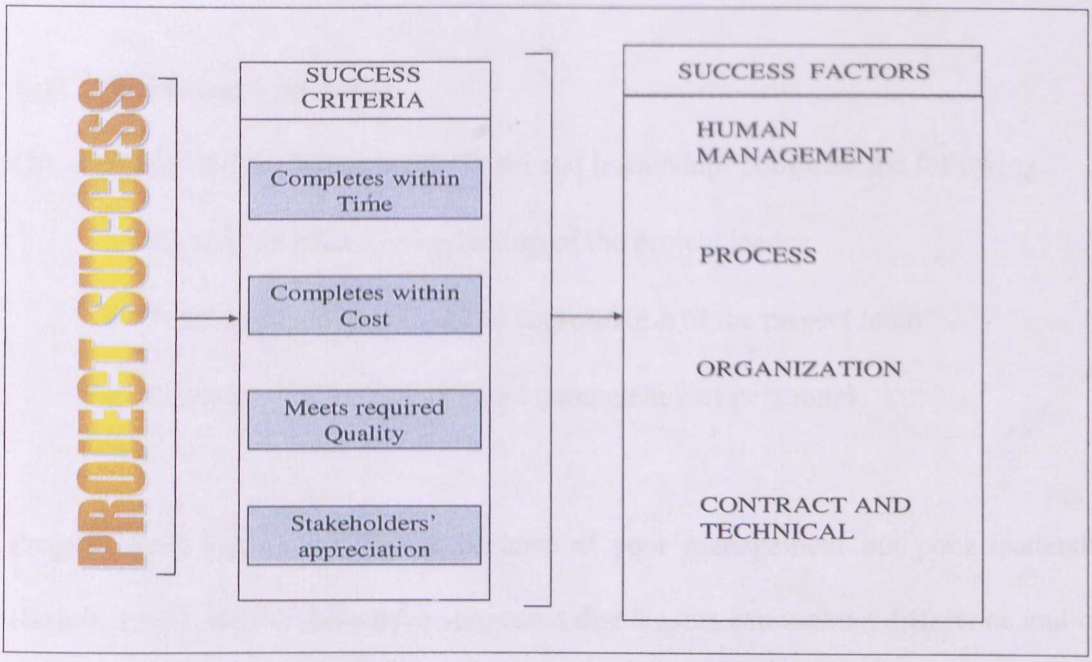


Figure 2.22: Success criteria and success factors

The following literature review are significant success factors that are required to ensure project success classified under the groups of '*Human management*', '*Process*', '*Organization*', and '*Contract and technical*'. The identification of significant success factors and the classification under the various success factor groups are formulated through factor analysis as described in detail in Chapter 4.

2.7.3 Human management

The success factor group as highlighted in the proceeding literature review is with regard to human management. The factors that comprise human management are:

a. Team and leadership
b. Project manager
c. Communication
d. Stakeholder management

The success factors grouped under human management that affect the project success identified by various authors are tabulated as Appendix 4.

(a) Team and leadership

The literature and deliberation on 'Team and leadership' comprise the following:

- Capable or effective leadership of the project leader
- Teamwork, cooperation and coordination of the project team
- Commitment, sufficiency and competency of personnel

Projects have known to fail not because of poor management but poor leadership (Smith, 1999). Researchers have suggested that leaders can make a difference and can have a significant effect in the organizations. This is because leadership involves managing and dividing tasks and responsibilities of the project (Westerveld, 2003), exerting influence over team members and helping the team to achieve its goals (George and Jones, 1999) and it serves as human glue binding the team together (Whitten, 1996).

Theories about leadership have been developed throughout the history of man (Partington, 2003). Starting from the 1940s, several main schools of thoughts on leadership have emerged. Trait theory differs from behavioral theory stating that leaders are born not made. Contingency theory believes effective leaders depends on situation, visionary theory identifies leaders as transformational and transactional, and emotional intelligence theory views leadership based on his emotional intelligence. Lastly, the competency approach combines the previous schools of thoughts on leadership theories stating that leaders can be made, based on their competencies and style under different circumstances. Turner and Muller (2005) summarize these leadership theories as shown in Table 2.13.

Table 2.13: Six main schools of leadership theory

Leadership Theory	Description
Trait approach (Up to 1940s)	Effective leaders are born not made and share common traits namely ability, personality and physical appearance.
Behavioral approach (1940s-1960s)	Effective leader adopt certain styles and include concern for people, authority, and flexible. They can be made, not just born.
Contingency approach (1960s-1970s)	What makes an effective leader depend on the situation i.e. directive, supportive, participative and achievement-oriented.
Visionary approach (1980s-1990s)	Leaders leading their organization through change. It identified two types of leadership i.e. transformational and transactional.
Emotional Intelligence approach (1990s)	Impact of leader's emotional intelligence i.e. self-awareness, self-management, social awareness and relationship management.
Competency approach (Late 1990s)	Effective leaders can be made, not just born. Different combinations of competencies can lead to different style of leadership appropriate in different circumstances.

Source: Adapted from Turner J.R and Muller R (2005)

In the study of Nigeria's construction industry, Odusami et al (2003) conclude that leadership styles significantly affect the overall project performance and suggest that the consultative autocrat style give the best overall project performance. This style of leadership takes into account the participation, contribution and suggestion of team members and the project leader will then make the ultimate decision. The autocrat leadership style is the least effective as all authority lies with the project leader. A study by Prabhakar (2005) suggests that there is a positive correlation between transformational leadership and project success. Transformational leader is one that inspires, motivates and empowers team members to believe and enthusiastically works towards the identified goals. For the leadership to be effective resulting in positive performance from the team members, the leader needs to resilient and adapt to the circumstances of the environment and the project team (Hutchins 2000) and team diversity (Huuhka et al, 2004).

Thamhain (2004) conducts a study to understand the correlation between team performance and leadership. The study focuses on five sets of team performance influences namely people, work, process, tools and techniques, and leadership as shown in Figure 2.23. Thambian (2004) observes that it is leadership that binds the whole concept of project teamwork functioning within the project environment.

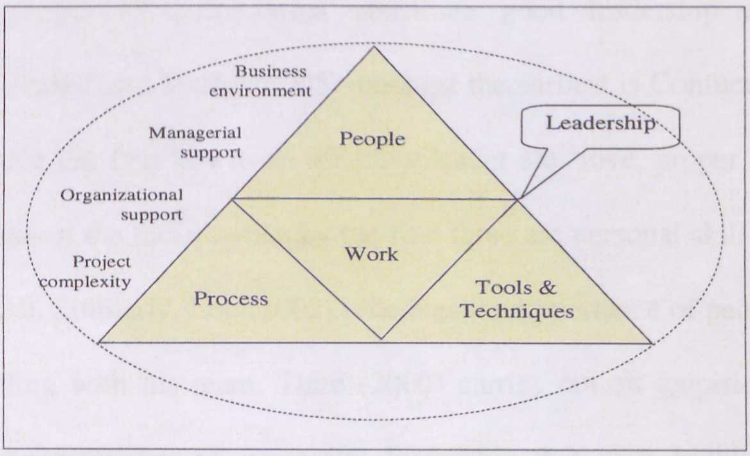


Figure 2.23: Influences to team performance

Source: Thamhain H.J (2004)

Studies have shown that leadership style may need to switch throughout the project life cycle (Turner and Muller, 2005). Rowlinson et al (1993) explore the leadership style in Hong Kong construction industry and the finding indicates that during the feasibility study the project leaders are more inclined to use a supportive style switching to a directive style during the contract implementation. Similarly, Turner and Muller (2005) suggest Laissez-faire style during feasibility study, democratic style during design, autocratic for the execution and bureaucratic for the close-out stage. However, a study by Prabhakar (2005) across twenty-eight nations reveals otherwise where the style is autocratic at the start switching to a more consultative approach as the project progresses alternating with autocratic approach if there is any problem. These different styles of leadership are summarized in Table 2.14.

Table 2.14: Leadership styles across project life cycle

Classification of work	Rowlinson et al (1992)	Turner and Muller (2005)	Prabhakar (2005)
Feasibility Study	Supportive	Laissez-faire	Autocratic
Design	Supportive	Democratic	Autocratic
Execution	Directive	Autocratic	Consultative & Autocratic
Closed-out	Directive	Bureaucratic	Consultative & Autocratic

Source: Various authors as stated

Many have sought to define what constitute good leadership characteristics. According to Turner and Muller (2005) amongst the earliest is Confucius in 500 B.C who believe that the four key to an effective leader are 'love, proper conduct, piety and the doctrine of the mean' whereby the first three are personal skill and the last is managerial skill. Similarly, Loo (2002) reiterates the importance of personal skill of a leader in dealing with his team. Thite (2000) carries out an empirical research to explore the characteristics of successful leadership that were highly rated by the project team members as shown in Table 2.15. He terms these characteristics as catalyst, intellectually stimulating, charisma, task and reward, and monitoring errors.

Table 2.15: Successful leadership characteristics

Highly rated Characteristic	Description
Organizational catalyst	Encourage team members to explore solutions to problem, satisfy their desire for autonomy, preventing organizational bureaucracy from interfering and provide a constructive link between them and the organization to achieve organizational goals without sacrificing their individuality.
Intellectual stimulation	Encourage unconventional thinking, question traditional ways and suggest new ways, emphasize value of questioning assumptions and prod at problems from different angles.
Charisma	Transformational leader with charisma and vision, strong sense of purpose, display conviction in beliefs and values.
Contingent reward	Transactional leader clarifies task and rewards, subordinates receive rewards for achieving performance targets.
Active monitoring of exceptions	Closely monitor performance for errors, irregularities and deviations from standards in order to enforce rules.

Source: Adapted from Thite (2000)

Other studies postulate characteristic of an effective leader that include charismatic and participative (Cheung et al, 2001), having the vision to envisage the uncertainties and what might go wrong and the passion and fervor to assertively deal with it (Black, 2004), not too soft and not afraid of not being liked (Whitten, 2003), and having the ability to make decision under uncertain circumstances and the strategy and leadership orientation (Rapp, 2004). Rowlinson et al (1993) observe that project leaders in Hong Kong prefer to rely on influence and persuasion as compared to using authority and command.

Hussein J, the Managing Director of the developer for the mega project KL International Airport in Malaysia states that managing people is the difficult part of the project (KL International Airport Berhad, 1998). With as many as 30,000 people from different work cultures and disciplines on one site, human management is an enormous task. There are generally three main groups involved: "the government servants trained to observe procedures and system; the private sector consultants and contractors focused on getting the job done quickly and willing to take risks and confront mistakes as they go along; and the migrant workers who came from different parts of the world with different socio-economic backgrounds". It requires competent and capable leadership to integrate and manage the human elements to ensure efficient implementation of the project.

Project Management Institute (2004) emphasizes the importance of not just managing but leading the team to produce results. Managing deals with process and system while leadership deals with people. Managing is predominantly with regards to constantly meeting stakeholders' requirements (Project Management Institute, 2004), is an operational function used in guiding the organization and implementation of projects (Bubshait and Farooq Gulam, 1999), and involving administering and maintaining activities (Walker and Peterson, 2001). Leading, on the other hand, is more than just managing people as it involves establishing direction, visions and strategies, aligning the people to achieve the visions, and motivating and inspiring the people (Project Management Institute, 2004), and the 'art and skill that cements everything together and makes things happen' (Bubshait and Farooq Gulam, 1999).

Smith (1999) notes that a leader is not one who manage, assign tasks, coordinate and document results but a leader who add value by not only directing but also communicating through doing work themselves. According to Christenson and Walker (2004) the leader must be charismatic enough to be seen as the teacher, mentor and coach and having the ability to structure and articulate problems that makes team members understand the problems and able to effectively resolve them.

As to who is to provide the leadership in the team, Project Management Institute (2004) argues that it should not be limited to only the project leader but by individuals at all levels of the project and at different times during the project. But this could only be achieved if all the project team members understand the purpose, objective and impact of the project. Christenson and Walker (2004) postulate that this could be accomplish through an inspiring and shared vision communicated to the project team. They define project vision as the project's soul because "it anchors project participants through their core values to a project outcome that all can relate to'. It is crucial that the vision should have a sense of purpose that would not only challenge but also motivate the team members (Collis and Montgomery, 1997 and Parker, 2001)

Apart from effective leadership, the other dimension is effective team building and teamwork (Westerveld, 2003). The project team is an assembly of individuals within an organization collaborating on a common task (Hoegl and Gemuenden, 2001) and each individual came with their own baggage of different needs, background and expertise (Bubshait and Farooq, 1999).

Several studies were carried out to answer the question of whether the composition of the team would affect team's performance. Studies by Simkoko (1992) and Odusami et al (2003) suggest that a cohesive project team have a significant positive impact on the project performance. According to Muriithi and Crawford (2003), motivational theories (such as Maslow's hierarchy of needs, McClelland's theory of need for achievement and Herzberg's two-factor theory) could be used to motivate team members, but the main motivating values depends on the team composition. Thus team formation, though difficult to accomplish is an important aspect to ensure cohesiveness (Raiden, Dainty and Neale, 2004). Apart from technical competence and availability of the personnel, team selection must also take into consideration the make-up personalities of the team (Adams, 1994 and Reid, 2003), the ability to work together as a team and diversity of characteristics (Dewhirst, 2001).

Odusami et al (2003) postulate that in comparing three types of team composition of in-house consultants, external consultants and consortium, the best overall project performance is scored by the team of in-house consultants. They offer two reasons for this. Firstly, information is free-flow as it is easily communicated due to the proximity of their work-stations, and secondly the team members know and are familiar with each other as they have worked together in other projects.

However, according to Raden, Dainty and Neale (2004) in-house consultant may not necessarily be the best option. Organizations are known to put together a project team from various sources that may not complement one another as the tendency is to meet the required abilities rather than being able to work as a team. The team members may comprise newly recruited staff with little knowledge of the organization, or taken from existing project due to their abilities, or being released from other completed projects, or deployed from another organization. As such, this rapid formation of project team may not result in cohesive teamwork within the team members.

It is common for companies to subject team members to psychometric testing to determine their personality and behavior and their subsequent roles within the project team to ensure cohesive teamwork. These tests are based on five of the most commonly applied theories of team member behaviors (Turner and Muller, 2005) as shown in Table 2.16. Generally, all these theories examine the way people react with each other and the main differences are the terms and the type of team roles.

Table 2.16: Five most common theories on behaviors of team members

Theories	Description
Fundamental Interpersonal Relations Orientation-Behavior	Examines the way people react with each other involving three types of behavior i.e. Inclusion, Control and Affection.
Belbin	Identifies nine team roles i.e. Plant, Team worker, Monitor-evaluator, Implementer, Shaper, Completer-finisher, Coordinator, Specialist and Resource investigator.
Margerison and McCann	Team roles adopted by individual depend on the extent to which they apply two fundamental behaviors i.e. Controlling behavior to Exploring behavior, and Advising roles to Organizing roles.
16 Personality Factors (16PF)	16 personality factors that influence a person's performance in a team involving 3 main groups i.e. Extroversion versus Introversion, Emotional stability and Others.
Myers-Briggs Type Indicator	An indication of individual's thinking style and temperament in a team i.e. Introversion to extroversion, Thinking to feeling, Sensing to intuition and Judgment to perception.

Source: Adapted from Turner and Muller (2005)

In assembling a project team, it include team members' experience, knowledge, commitment and persistence (Chatzoglou and Macaulay, 1997) qualification, availability, interest level, chemistry, and balance or synergy (Thomas, 2000). Kloppenborg and Petrick (1999) develop team character traits for each phase of the project life cycle. Using a generic four-stage project life cycle model, Kloppenborg and Petrick (1999) describe the team character traits as shown in Table 2.17. They categorize the team character traits into five virtues namely intellectual, social, emotional, moral and political virtues. These virtues differ to deliver the different activities required for each of the project life-cycle stage.

Table 2.17: Project life cycle stages and team character traits

Project life cycle stage	Team character traits	Typical activities
Planning	Intellectual virtues - Imagination, knowledge and foresight	• Identify final deliverables, goals, constraints, priorities and risks • Determine feasibility
Process organizing	Social virtues – Cooperation, respect and trust Emotional virtues – Expressiveness, commitment and emulation	• Detail activities, cost and schedule • Team selection, training, commitment and development
Implementing and controlling	Moral virtues – Honesty, courage and Prudence	• Procure resources, complete project activities, monitor progress, replan as needed
Evaluating and system improving	Political virtues – Justice, inclusiveness and citizenship	• Evaluate process, result, personnel • Reassign workers and resources • Improve system and people through lessons learned

Source: Kloppenborg and Petrick (1999)

Thamhain and Nurick (1994) emphasize variables that could influence the performance of a project team as shown in Figure 2.24. The emphasis is on tasks and relationship, which amongst others involve the ability to resolve conflict, trust, communication, culture, motivation within a project environment.

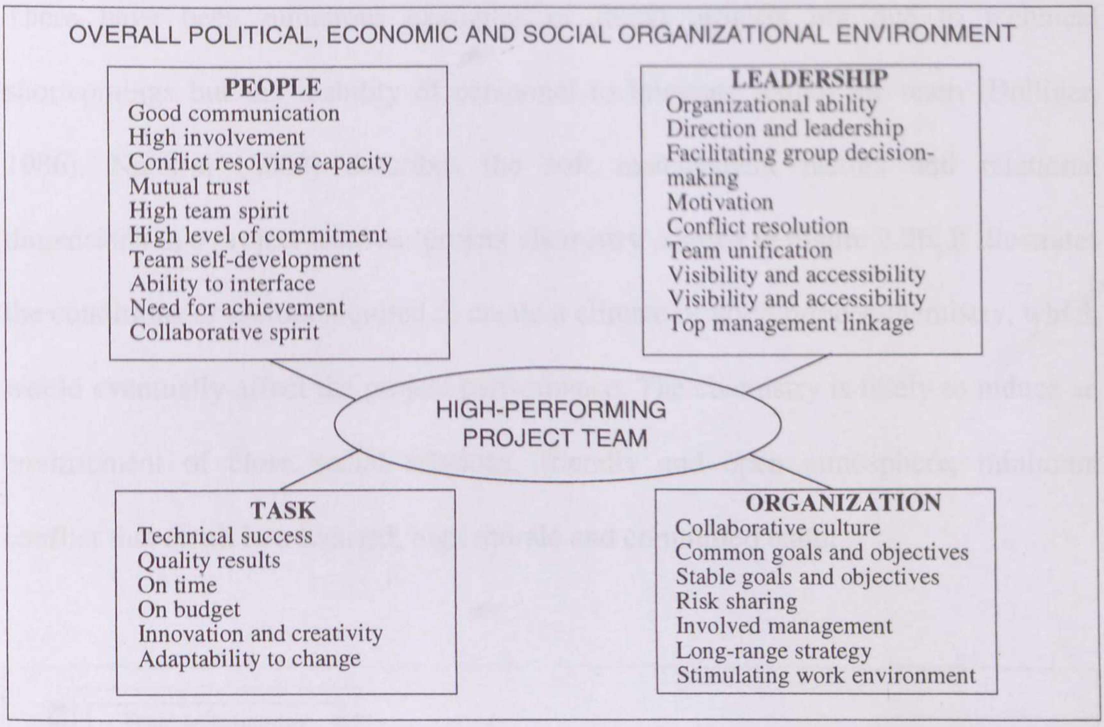


Figure 2. 24: Variables influencing the performance of project teams

Source: Thamhain H.J and Nurick A.J (1994)

Hoegl and Gemuenden (2001) develop 'Teamwork Quality' framework to emphasize collaboration between team members, resulting in effective performance and personal success. The collaborative process through communication, coordination, balance of member contribution, mutual support, effort and cohesion as shown in Figure 2.25.

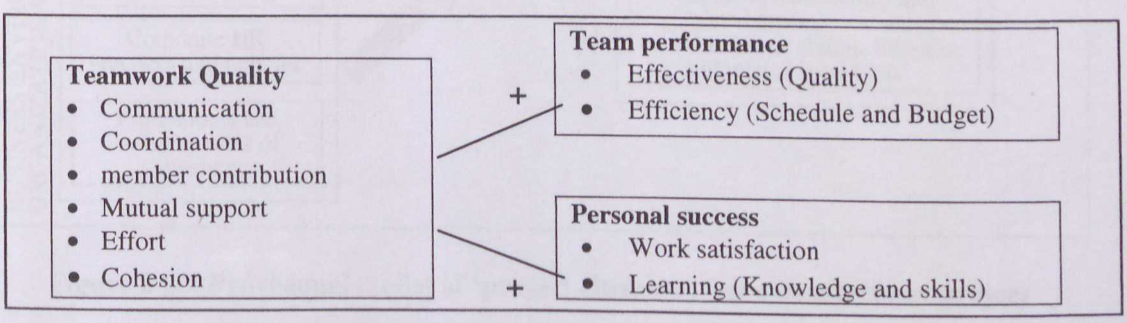


Figure 2.25: Teamwork Quality

Source: Hoegl and Gemunden (1999)

There have been numerous examples of failed projects not due to technical shortcomings but the inability of personnel to integrate within the team (Bolliger, 1986). Nicolini (2002) describes the soft management factors and relational dimensions in a project team as 'project chemistry' shown in Figure 2.26. It illustrates the conditions or factors required to create a climate of good project chemistry, which would eventually affect the project performance. The chemistry is likely to induce an environment of close social relations, friendly and open atmosphere, minimum conflict that result in a focused, high morale and committed team.

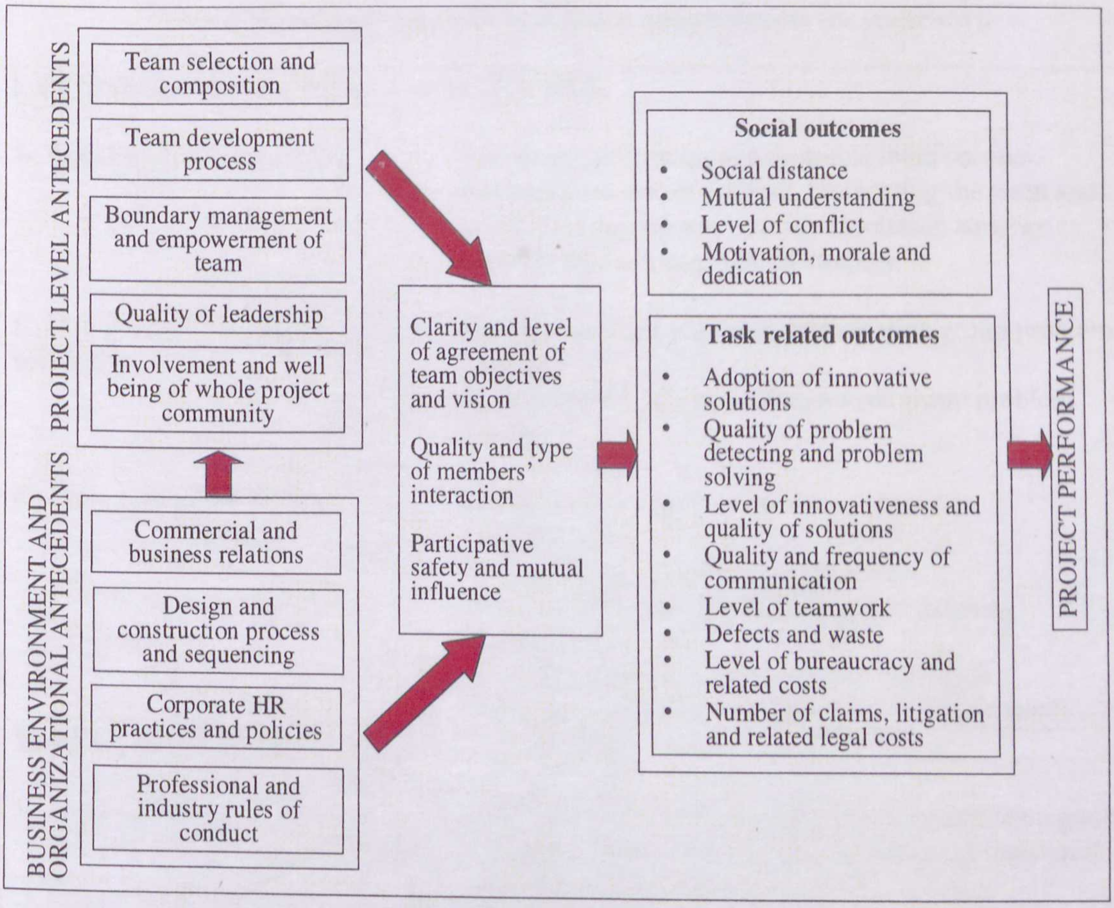


Figure 2.26: Provisional model of 'project chemistry' and its effects on project performance

Source: Nicolini (2002)

Back and Seaker (2004) emphasize on another aspect of the team dynamics that is the skills and abilities to learn, assess, and change and adapt where required. Stevens and Campion (1994) summarize the necessary knowledge, skill and ability (KSA) required of the team leader to ensure effective teamwork amongst the project team members as shown in Table 2.18. There are fourteen specific KSAs that are classified under five different sub-categories. The sub-categories of conflict resolution, collaborative problem solving and communication are interpersonal KSAs and goal setting and planning are self-managed KSA.

Table 2.18: Knowledge, skill and ability requirements for teamwork

I. INTERPERSONAL KSA	SPECIFIC KSA
A. Conflict Resolution KSA	1. Recognize and encourage desirable team conflict. 2. Recognize source of conflict confronting the team and implement appropriate conflict resolution strategy. 3. Employ win-win negotiation strategy
B. Collaborative Problem solving	4. Identify situation requiring participative group problem solving 5. Recognize obstacles to collaborative group problem solving
C. Communication KSAs	6. Utilize decentralized network to enhance communication 7. Communicate openly and supportive 8. Listen nonevaluatively and use active listening techniques 9. Recognize and interpret nonverbal messages 10. Recognize importance of ritual greetings and small talk
II. SELF-MANAGED KSA	
D. Goal setting	11. Establish specific, challenging and accepted team goals 12. Monitor, evaluate and provide feedback on individual and team performance.
E. Planning & Task Coordination	13. Coordinate and synchronize activities, information and task interdependencies between team members 14. Establish task and role expectations of team members to ensure proper balance of workload in the team.

Adapted from Stevens and Campion (1994)

In addition, Crawford (2003) emphasizes the importance of competency of not only the leaders but also each of the team members. According to him, competency is the subset of knowledge, skills, core personality and output as shown in Figure 2.27.

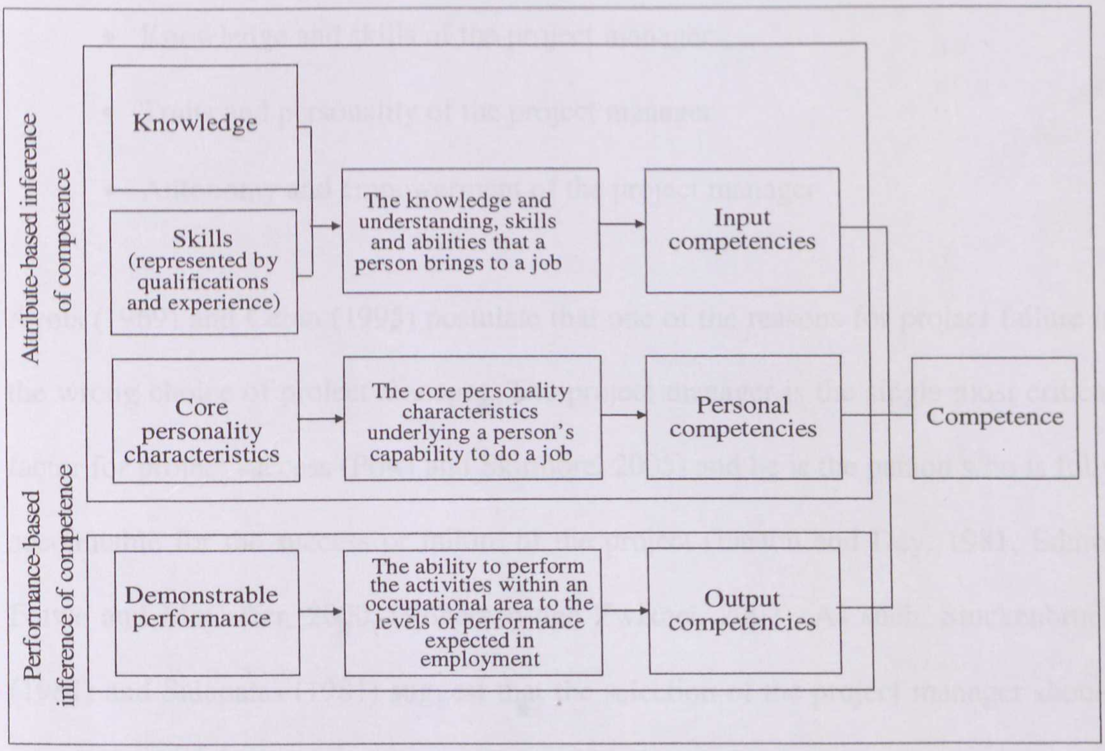


Figure 2.27: Integrated model identifying key components of competences

Source: Crawford (2003)

Diallo and Thuillier (2004) summarize the factors that affect team performance are descriptive factors dealing with organizational issues and structure, support factors focusing on competencies and communication, and abstract factors concerning with commitment, cooperation and empowerment. A study by Thamhain (2004) suggests that the most significant drivers are external drivers that include interesting work, clear objectives, direction and leadership, cross-functional cooperation, effective communication, and autonomy; and internal drivers that include accomplishment, recognition, respect, and career development. The least significant are salary, bonuses, and project characteristics.

(b) Project manager

The literature and deliberation on 'Project manager' comprise the following:

- Perception on the role of the project manager
- Qualification and experience of the project manager
- Knowledge and skills of the project manager
- Traits and personality of the project manager
- Autonomy and empowerment of the project manager

Avots (1969) and Ceran (1995) postulate that one of the reasons for project failure is the wrong choice of project manager. The project manager is the single most critical factor for project success (Powl and Skitmore, 2005) and he is the person who is fully accountable for the success or failure of the project (Easton and Day, 1981, Edum-Fotwe and McCaffer, 2000, Globerson and Zwikael, 2002). As such, Stuckenbruck (1981) and Salapatas (1981) suggest that the selection of the project manager should be done as early as the inception stage of the project.

A study by Gobeli and Larson (1987) suggest that where the project manager has a strong formal role, it has a positive impact on the performance of the project. The role of a project manager encompasses the whole facet of the project. He is fully responsible for every aspect of the project from the executive control, technical tasks, and commercial aspect to managing the staff (Walton, 1984) with project integration as the key function (Ogunlana et al, 2002). Walton (1984) summarizes the importance of project manager by describing the project manager as one who is required to be a 'total' man. According to Tan (1996), he has to be an all-rounder that includes as 'a monitor, progress chaser, controller, reporter and expeditor' as shown in Figure 2.28.

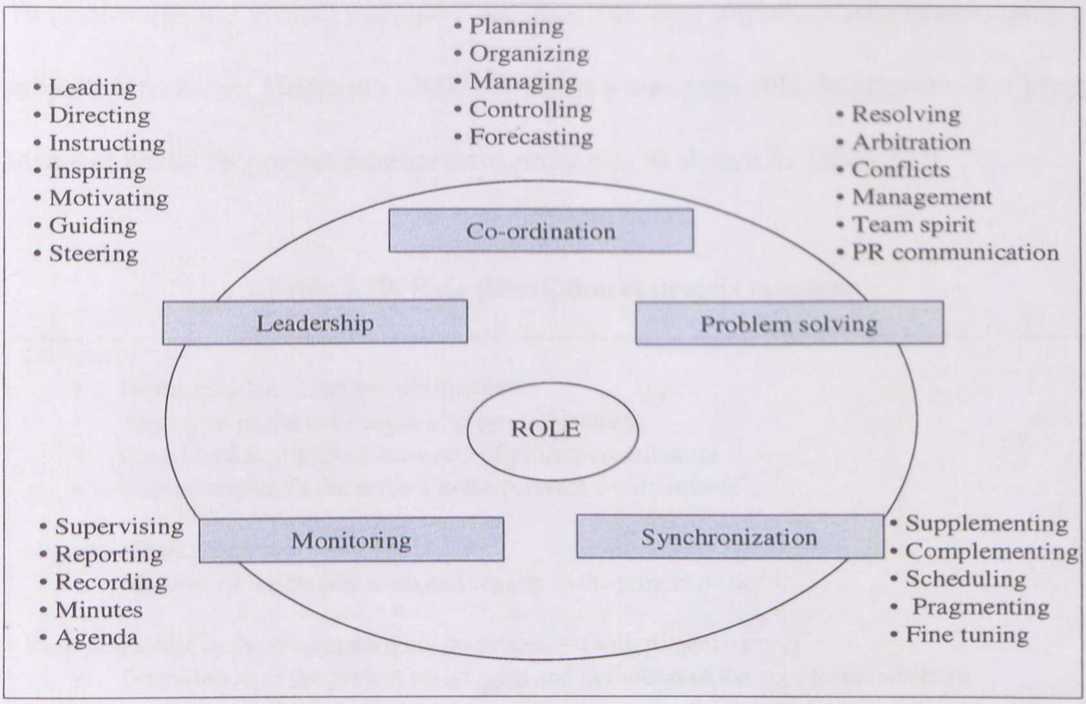


Figure 2.28: Role of a project manager

Source: Tan (1996)

Others list the project manager's tasks that include project evaluation, setting up the team and systems, planning, monitoring and control, negotiating contract conditions, training and communication (Walton, 1984) leading project team, building client partnerships, and targeting to the business (Wysocki et al, 1995). However, Ceran (1995) notes that although project management literature is flooded with books, article and manuals on the role of project managers but problems and failures by project manager in managing projects continues to happen. He further observes that what are lacking are standards of performance for project manager to be what he terms as 'The Complete Project Manager'. He develops a twelve categories standard of performance namely quality management, project acquisition, project work plan, project controls, financial goals, change orders, client relationship, managing sub consultants, partnering, project close-out and follow-up, staff management and development and professional and community activities.

To ensure that the project managers are aware of their important role in managing the project, Gareis and Huemann (2003) develop a one-page role description of a project manager based on project management processes as shown in Table 2.19.

Table 2.19: Role description of project manager

Objectives • Representation of the project interests • Assurance of the realization of project objectives • Coordination of project team and of project contributors • Representation of the project to the relevant environments
Organizational position • Member of the project team and reports to the project owner
Responsibilities in the project assignment process – (with project owner) • Formulation of the project assignment and definition of the core team members
Responsibilities in the project start process – (with project team members) • Organization of the project start process (with core team members only) • Know-how transfer from pre-project phase into the project • Agreement on project objectives and development of adequate project plans • Design of an adequate project organization • Development of a project culture, establishment of the project as a social system • Performance of risk management and discontinuity management • Design of project context relations • Implementation of project marketing
Responsibilities in the project coordination process • Disposition of resources for the performance of work packages • Controlling the results and ensuring the quality of work packages • Approval of work package results • Communication with team members and representatives of relevant environments • Project marketing
Responsibilities in the project control process – (with project team members) • Organization of the project control process and determination of project status • Agreement on or planning of corrective actions • Further development of project organization and project culture • Redefinition of project objectives and redesign of project context relations • Project marketing • Preparation of progress reports
Responsibilities in the management of project discontinuity process/crisis or change management • Organization of discontinuity management process with project owner • Contributions to contents of the crisis or change management with project team members
Responsibilities in the project close-down process – (with project team members) • Organization of project close-down process and emotional close-down of the project • Transfer of know-how into line organization including with line managers • Final project marketing

Source: Adapted from Gareis and Huemann (2003)

Having such responsibilities require a project manager to undergo formal education and training (Walton, 1984), experienced (Stuckenbruck et al, 1981, and Yasin et al, 2000) and having the knowledge in other fields of arts and science (Gaddis, 1959 and Laszlo, 1994). According to Ceran (1995), a project manager need not necessarily be from a specific discipline as long as he is not only proficient in his own discipline but also has an appreciation of all the involved disciplines and equally interested in the technical solution of the project including schedule and budget control.

Edum-Fotwe and McCaffer (2000) outline the knowledge input that a project manager is required to acquire based on the PMI nine knowledge areas that include knowledge on integration, time, cost, procurement, quality, communication, risk, scope and human resources as shown in Figure 2.29.

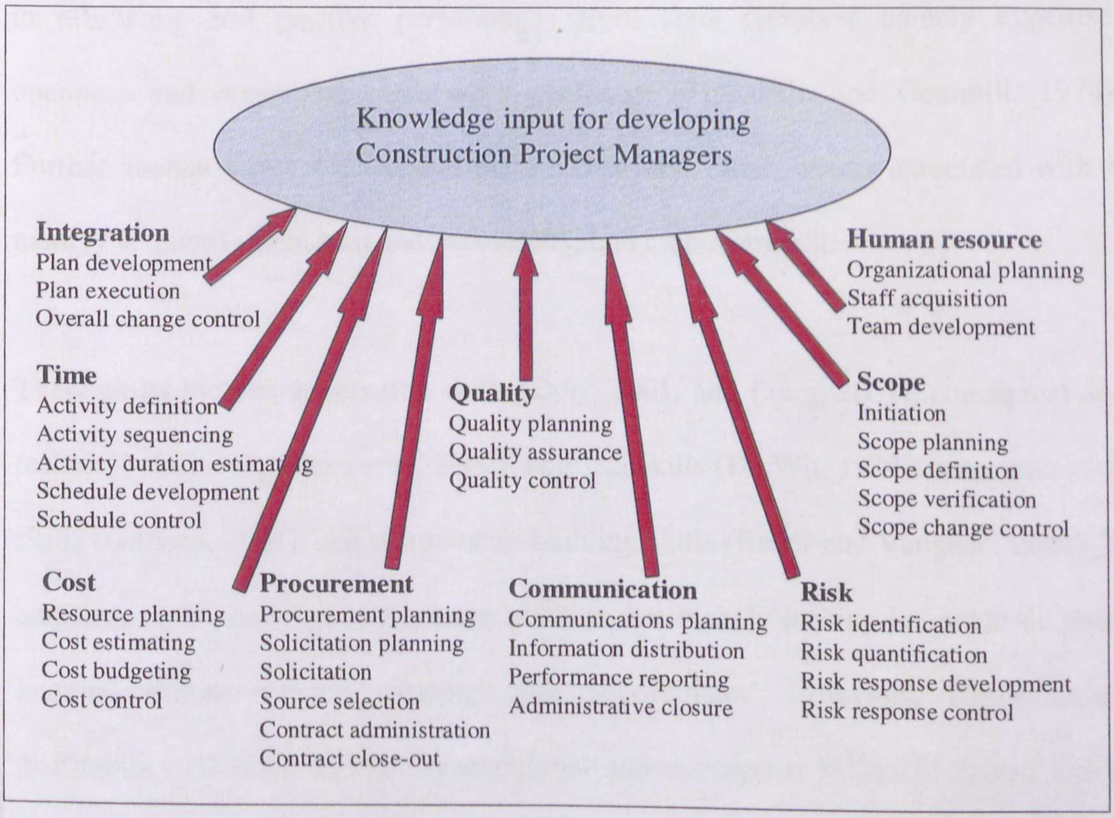


Figure 2.29: Generic knowledge areas of project management

Source: Edum-Forte and McCaffer (2000)

It is imperative that a project manager also acquires knowledge in other fields. These include the field of finance, marketing, organizational theory and public relations (Laszlo, 1994), an appreciation of the environmental economic, cultural and social concerns (Ceran, 1995), the field of science and the advanced-technology environment, general management, law and personnel administration (Gaddis, 1959).

Stuckenbruck et al (1981) conduct a case study on construction projects that reveals the experience of project managers as one of the predictor of project success. Further studies support this conclusion where international experience contribute to the makings of a project manager who is more focused, people-oriented and technically competent (Yasin et al, 2000, and Yasin et al, 2002).

Early studies correlate certain characteristic of the project manager that would result in efficiency and positive performance from team members namely expertise, openness and emphasizing on work challenge (Thamhain and Gemmill, 1974). Further studies conceptualize that there are several other aspects associated with it namely acquired skills, trait and personality, and empowerment.

These skills include negotiation skills (Dorr, 2001, and Long, 2001), conceptual and technical skills (Ogunlana et al, 2002), political skills (De Wit, 1988), communication skills (Githens, 2001), and relationship-building skills (Rader and Vaughan, 2001). In addition, he is also expected to have abilities that include making judgment on risks, keeping things moving, dealing with subordinates' behaviors, organizational profitability (Gaddis, 1959), organizational and conceptual skills (El-Sabaa, 2001), creativity, and integrative thinking (Hauschildt et al, 2000), leading, communicating, negotiating and problem solving skills (Edum-Fotwe and McCaffer, 2000).

However, the most important skill that a project manager needs to possess is 'people' skills. Some term it as human skills (El-Sabaa, 2001), exceptional human relations skills (Stuckenbruck, 1981), social attitude and human values (Todryk, 1990), excellent interpersonal skills (Ceran, 1995) and soft or people-related skills (Stuckenbruck, 1981, Sotiriou and Wittmer, 2001, and Petersen and Murphree, 2004). Sotiriou and Wittmer (2001) note that a project manager not only need to possess the required skill to manage tasks (including technical aspect, tools and techniques) but also the necessary skill to manage people (to motivate staff to accomplish objectives).

Walton (1984) states that the project manager need to realize that apart from his education, training, experience, knowledge and skills, it is his personalities that at the end 'determine his stature in the profession'. The project manager needs to inculcate consciously self-disciplines at all levels in discharging his responsibilities. These levels are physical (health and care), emotional (cheerfulness, compassion and serenity), mental (impartiality, concentration and precision), creative and intuition (creativity), and at the total level (a balanced life). Apart from this Ritz (1994) includes ethics, integrity and common sense as a personality traits that are equally important.

The project manager's inherent trait and personality include his leadership quality and positive attitude (Iyer and Jha, 2005), good judgment (Gaddis, 1959) and impeccable personality (Walton, 1984) or dominant personality (Ritz, 1994). Dainty et al (2005) summarize the competencies required of a project manager as 'input-based criteria' i.e. personal characteristics, behaviors, traits and skills and 'output based criteria' i.e. the project manager's performance and action oriented competencies.

According to Wysocki et al (1995), there are two levels of qualities or characteristics required of a project manager namely the required skills that are visible and can be acquired through training, and the competencies that are the hidden trait and more difficult to develop.

The selection of a project manager must take into consideration the personality (Dvir et al, 2006) and management style (Muller and Turner, 2007). There must be a fit between his personality and management style and the type of project he will be responsible. Morton et al (1981) note the dilemma that a project manager may face in attempting to achieve the conflicting objectives of his organization, client, and his own personal development goals. He needs to possess the ability to be fair and make a judgment to balance these objectives to ensure project success. Gaddis (1959) refers this as reasonable 'projectitis' i.e. balancing between management and technologist, and balancing between importance of the project and the whole organization.

In addition, to enable him to discharge his duties effectively, the project manger needs to be sufficiently empowered to make decisions (Iyer and Jha, 2005), have sufficient authority (Turner, 2004) and autonomy (Rao, 2001) and getting involved to exert his presence in the project by participating in top management control meetings (Iyer and Jha, 2005). This is to enable the project manager to balance conflicting objectives (Morton et al, 1981), to influence and motivate team members (Sotiriou D and Wittmer D, 2001) and to judiciously use power and political behavior to influence and manage (Pinto, 2000). To achieve these, Barber (2004) recommends that project manager use benchmarking on the skills and competencies of previous project managers as a tool to improve his managerial skills

Being empowered and given sufficient authority level will enable the project manager deal with all the risks and uncertainties of managing the project (Turner, 2004) However, there must be a balance between the level of authority and the structured organization as too much structure will result in inflexibility and too little structure will result in laissez-faire management and anarchy. According to Cleland and King (1983) the project manager is responsible across functional (functional and line managers) and organizational (project team) lines to bring together and integrate all the required activities to achieve the project objectives.

Gaddis (1959) concludes that the responsibilities of a project manager often far outweigh his authority. According to Einsiedel (1987), in the case where a project manager is being assigned to a project he has no control within a restrictive organizational structure, it is his personality and skill that would assist him in performing his roles effectively in such environment. To overcome authority gap, a project manager need to possess persuasive ability, negotiation and management competence (Sotirou and Wittmer, 2001), and tremendous amount of skill, persistence, professionalism and positive attitude (Gaddis, 1959) in balancing between responsibility and authority.

(c) Communication

The literature and deliberation on 'Communication' comprise the following:

- Establishing or set-up a line of communication or information channel
- Ensure relevant parties are aware of the status or problem of the project
- Ensure timely and valuable information and decision are communicated

For years, researchers have agreed the importance of effective communication in achieving project success (Muller, 2003, and Diallo and Thuillier, 2004). Evidence has shown that projects fail due to communication breakdown (Clarke, 1999, Sievert, 1986, and Ives, 2005) or poorly organized communication channels (Barnes and Wearne, 1993). This apparent lack of effective communication may be due to the difficulty in assessing and measuring communication effectiveness (Thomas et al, 1999).

Communication is generally been defined as the exchange of information and for the exchange to be effective it should be clear, unambiguous and complete (Project Management Institute, 2004). Pietroforte (1997) states that project information must be communicated i.e. the information are sent, received and understood by all the relevant stakeholders to ensure necessary actions could and would be taken.

Naim A.R, the managing director of Kuala Lumpur City Centre Berhad, the project management consultant for the prestigious Petronas Twin Tower in Malaysia was quoted as saying 'One of the key elements of our success was an efficient, structured communications system with a well-defined methodology for reporting up and down. This enabled each team member to maintain a clear understanding of the project objectives, deliverables and milestones' (Chor, 1998).

Barnes and Wearne (1993) state that communication between the downstream and upstream parties must be clear especially when the decision of the upstream affect the downstream parties. Clarke (1999) reiterates that communication is not only within the organization influencing those involved but also across the whole stakeholder parameter who may be affected by the project.

Schultz et al (1987) describe the 10-factors of the critical success factors in a model that amplify the interrelationship of communication factor to other factors as shown in Figure 2.30. The model shows how communication is the main factor that connects the factors of mission, top management support, schedule, client consultation and acceptance, personnel, and technical tasks.

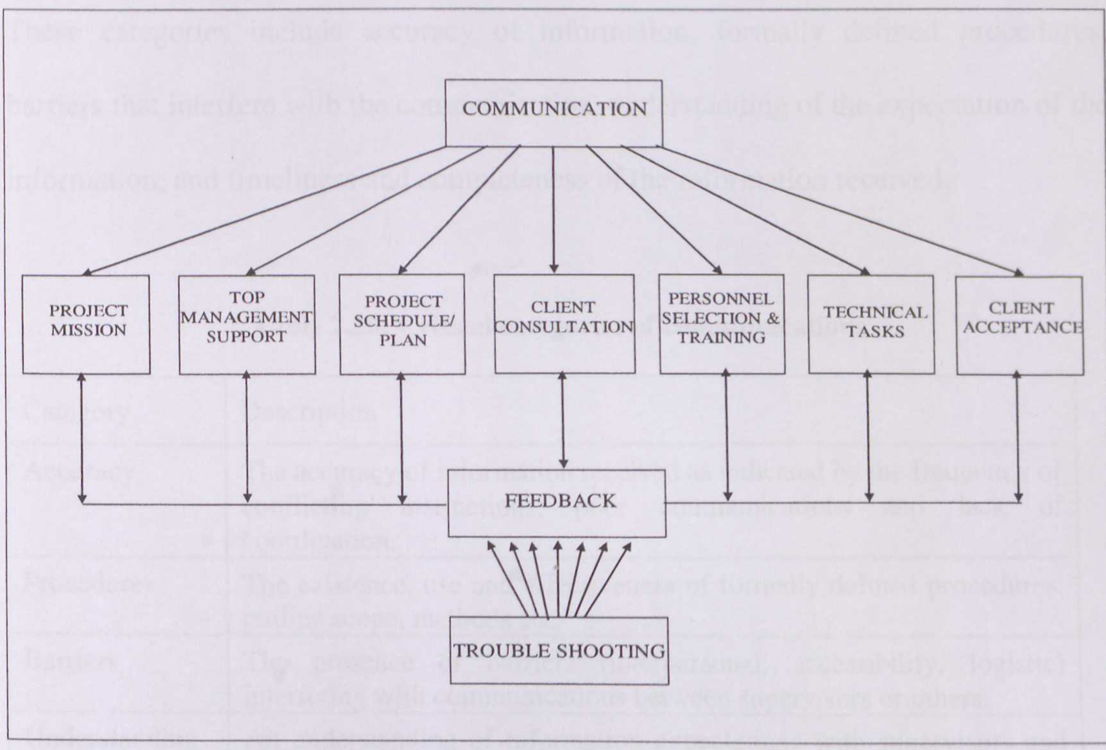


Figure 2. 30: Critical success factor interrelationships

Source: Schultz et al (1987)

Project communication management is the how, what, when and what form of communication to ensure timely collection, storage and dissemination of project information and ideas which provides the critical links to all the stakeholders (Project Management Institute, 2004). The process involves communication planning, information distribution, performance reporting and administrative closure.

Studies have postulated that the benefits of effective communication include better comprehension of the project, minimize non-productive effort, duplication and mistakes, alleviate uncertainties, early detection of problems, solicit better solutions for identified problems, encourage teamwork and motivation, and participation of key stakeholders (Clarke, 1999). Thomas et al (1999) in a study to measure the effectiveness of communications identify critical categories as shown in Table 2.20. These categories include accuracy of information, formally defined procedures, barriers that interfere with the communication, understanding of the expectation of the information, and timeliness and completeness of the information received.

Table 2.20: Critical categories of communications

Category	Description
Accuracy	The accuracy of information received as indicated by the frequency of conflicting instructions, poor communications and lack of coordination.
Procedures	The existence, use and effectiveness of formally defined procedures, outline scope, methods etc.
Barriers	The presence of barriers (interpersonal, accessibility, logistic) interfering with communications between supervisors or others.
Understanding	An understanding of information expectations with supervisors and other groups.
Timeliness	The timeliness of information received, including design and schedule of changes.
Completeness	The amount of relevant information received.

Source: Thomas et al (1999)

Giffin (2002) notes that since late 1990's businesses have been utilizing the e-mail as an efficient and quick communication system. The technological characteristics of the various internet applications as shown in Table 2.21 have been implemented in project management in various degrees as a communication tools by the project stakeholders.

Table 2.21: Utility of internet applications in project management

Internet applications	Descriptions	Technical attributes
E-mail	Electronic messaging service capable of sending text messages and attached files.	Useful for sending individual messages.
Static websites	Documents viewed in a Web browser that include text, images, files and hyperlinks.	Useful for dissemination of information to large group.
Web-based groupware	Web sites that implement groupware features i.e. personal task lists, calendars, e-mail, and private and shared folders.	Best suited for structured communication within moderate to large groups.
Discussion groups	Specialized messaging system that allows many users to review and respond to comments or questions from others.	Best suited for allowing large, unassociated groups to follow topics of interest.
Video/audio conferencing	Transmission of interactive voice or video images over a private network.	Best suited for interactive communication.
Text conferencing	Two-way interactive text conferencing with a potentially unlimited number of users.	Useful for interactive communication between larger/more divers groups.

Source: Adapted from Giffin (2002)

Abdomerovic, Blakemore and Stewart (2000) acknowledge the importance of communication to ensure that relevant stakeholders are informed of the project activities and status. However due to the massive amount of information it is imperative to identify which stakeholder needs what information to ensure that the reporting system is effective but relatively inexpensive to produce. In this respect, the Project Management Institute (2004) concludes that in generating an effective communication system three aspects need to be addressed namely assessment of needs, means of communication, and avoiding wastage by taking the following steps. Firstly, conduct a methodical and logical assessment of what information is required from all the different stakeholders and determine the source of the information. Secondly, elect the methods and technologies to convey the required information to these stakeholders. And thirdly attention to needs of the stakeholders to avoid wastage of resources, unwarranted information and unsuitable means of communication.

(d) **Stakeholder management**

The literature and deliberation on 'Stakeholder management' comprise the following:

- Client consultation, acceptance, participation and relationship
- Capture and address stakeholders' requirement for Project definition
- Manage bureaucracy
- Client's commitment and capabilities

Campbell and Baker (2007) and McElroy and Mills (2003) highlight the importance of stakeholders when they assert that managing project is synonymous to managing the stakeholders. In fact, the key role of the project manager and his project team is to seek, influence, identify and manage stakeholders' input and their expectations of the project (Jergeas et al, 2000, Wang and Huang, 2005, and Olander and Landin, 2005). Cleland and Ireland (2002) state that managing the stakeholders is necessary to understand the stakeholders' interest, behavior, reaction, interaction and influence on the project thus increasing the chance of project success. In understanding the stakeholders, the project team is able to restrain the stakeholders' adverse activities and take advantage of stakeholders' influence to support the project's objectives.

Project stakeholder management (PSM) has been defined as the assessment of influence and management of external project stakeholders (Cleland, 1986), interaction between the various project stakeholders and the stakeholders with other external parties (Westerveld, 2003) and the continuing development of relationships with stakeholders to achieve project success (McElroy and Mills, 2003). Jiang et al (2002), Muller (2003) and Turner (2004) agree that there should be collaboration between all the stakeholders and they should view the project as a partnership.

However, this collaboration may be difficult as stakeholders have different conflicting objectives. Olander and Landin (2005) state that the requirements or demands vary amongst the different stakeholders of the project. In managing the various key stakeholders efficiently and effectively, the Project Management Institute (2004) identifies the following: (1) Give priority to client's needs, (2) Create conducive environment to encourage stakeholders to contribute, (3) Document scope statements formally accepted by stakeholders, (4) Inform stakeholders authorized changes and revised cost estimates, (5) Identify needs of stakeholders and assign responsibilities, and (6) Establish lines of communication that ensure relevant and timely information.

McElroy and Mills (2003) illustrate PSM process as shown in Figure 2.31. PSM process emphasizes on identifying the key stakeholders who have vested interest on the project, capturing their needs and requirements and monitoring through agreed communication channels and procedures to ensure their satisfaction.

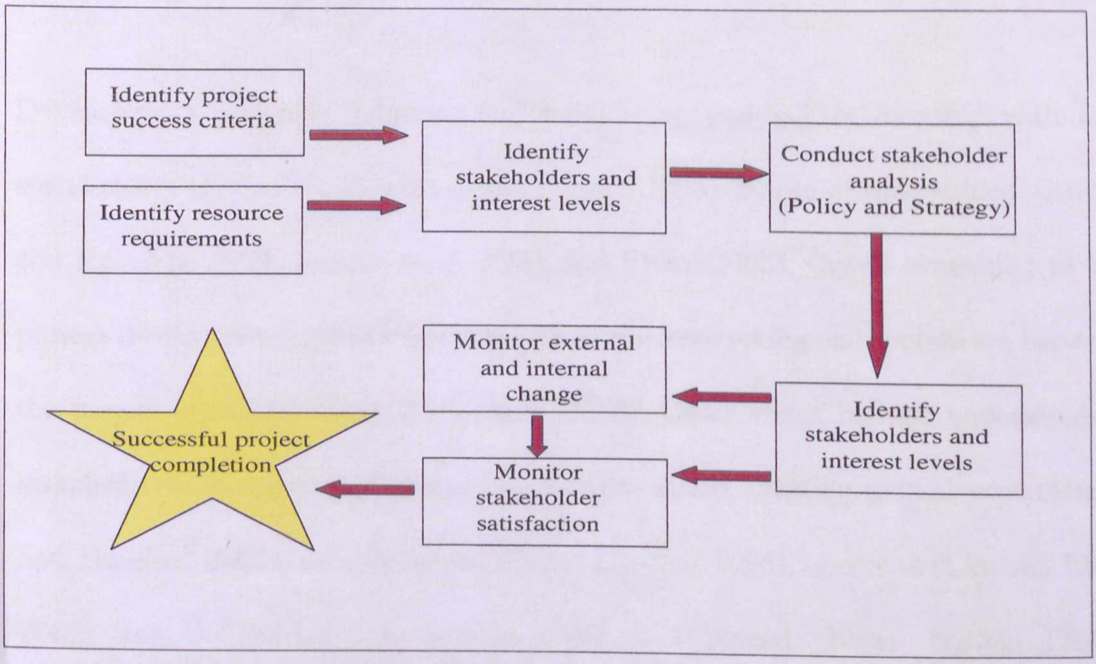


Figure 2.31: The stakeholder management process

Source: Adapted from McElroy and Mills (2003)

Thompson (1991) states that the client's role is crucial in the development and implementation of the project. Likewise, Pinto and Slevin (1994) postulate that client consultation and client acceptance as among the critical success factors. Ultimately, the project is intended for the client's benefit, as such it is critical that they be consulted, and their acceptance is obtained not only on vital issues, but also on every aspect of the project if so required by them. As such, fostering and sustaining a positive personal relationship is key to stakeholder management (VanEpps, 2001, Jiang et al, 2002, Chen and Partington, 2004, and Wang and Huang, 2005). Ward et al (1991) observe that apart from the time-cost-quality considerations, clients normally reflect on the quality of relationships with the project team. It is the memories of 'abiding impressions of harmony, goodwill and trust or, conversely, of arguments, distrust and conflict' that stick to the minds of key stakeholders. The findings from a study by Couillard (1995) conclude the significance of such human relationships between stakeholders in project performance.

Developing a personal influence and building-up personal relationship with key stakeholders involve social interaction (Youker, 1994), buy-in of stakeholders (Briner and Hastings, 1994, Jergeas et al, 2000, and Eldin, 2005), shared ownership of the project (Project Management Institute, 2004) and networking and socializing between the project team and client (Ling et al, 2006). Other views include understanding stakeholders' viewpoints (Olander and Landin, 2005), creating mutual trust (Diallo and Thuillier, 2004), gaining respect (Henri-Charles, 1995), openness (Lim and Ling, 2002) and collaboration to reduce conflicts (Vaaland, 2004). Nathan (2008) summarizes the importance of building relationship when he states, "touch the heart and built relationship".

Kamara et al (2000) report that its been known the main source of information regarding the project is the client and thus capturing and understanding this information by the project team will determine the outcome of the project. An effective project team is one that understands the client's requirement (Ling et al, 2006). Kometa et al (1994) point out that one of the important client attributes is in defining the project definition. Incomprehensive project definition or poor project scope has been identified by several authors as resulting in a dissatisfied client and the project team may experience difficulty in working with the stakeholders in future (Jergeas et al, 2000). It is thus of utmost importance that the requirements of the relevant key stakeholders are being captured and addressed in a project definition.

Abdul-Kadir and Price (1995) define project definition as 'the resolution of options during the conceptual phase which culminates in a statement of the client's requirements.' It is simply the need statement or requirements of the stakeholders mainly the client. Project definition has been similarly termed as project brief or project requirements.

Although project definition inevitably is regarding the needs of the project, it seems that other external aspects of the project are also to be considered. Kamara et al (2000) state that the project requirements do not only include the client requirements namely his needs and expectations with respect to functions, attributes or other special features of the facility that would satisfy his business needs but also include site, environmental and regulatory requirements as shown in Figure 2.32.

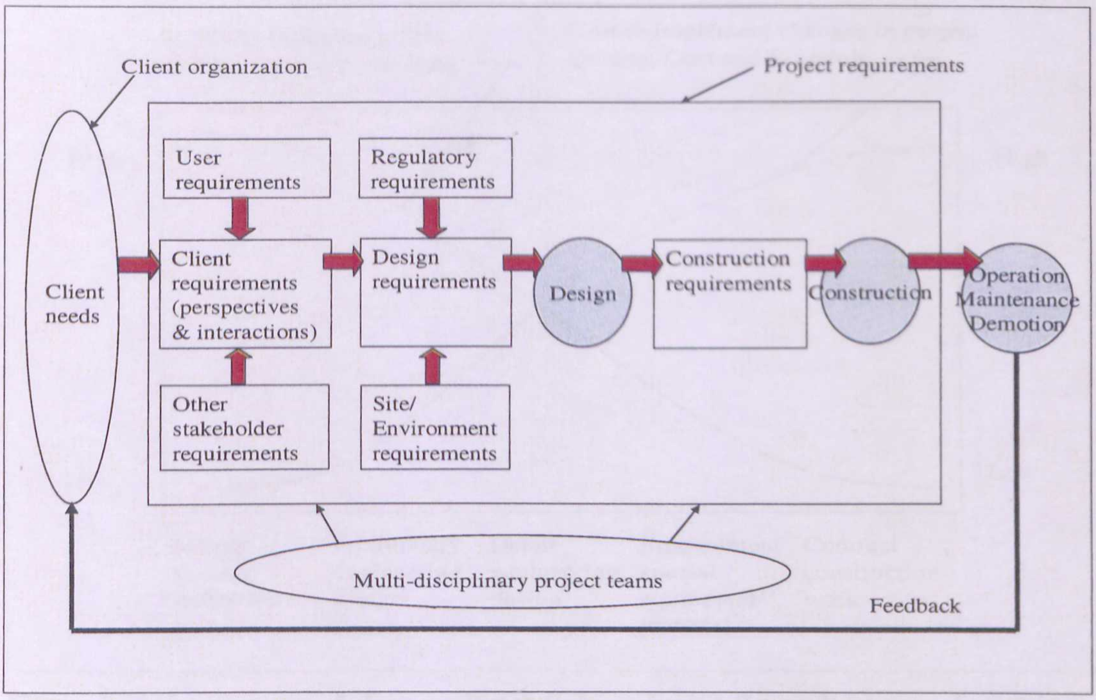


Figure 2.32: Interrelationships between project requirements in constructions

Source: Adapted from Kamara et al (2000)

It is critical that at the early stage of the project a clear initial project definition is captured and established (Chritamara et al, 2001) and agreed by the key stakeholders (Arditi and Gunaydin, 1997 and Leffingwell, 2001). Skulmoski and Hartman (1999) suggest that the stakeholders participate and be involved early in the planning stage and subsequently integrated in the project team. Another important aspect is the freezing of the project scope and all stakeholders are committed by refraining from making changes beyond the scope freeze point (Eldin, 2005).

Oberlender (1993) as quoted by Yates and Eskander (2002) postulate that in a construction project, the ability to influence project requirement is high and the cost to implement any changes is low during the project definition stage. Equally, the ability to influence changes to the project requirements is low and the cost to implement any changes is high during the construction stage as shown in Figure 2.33.

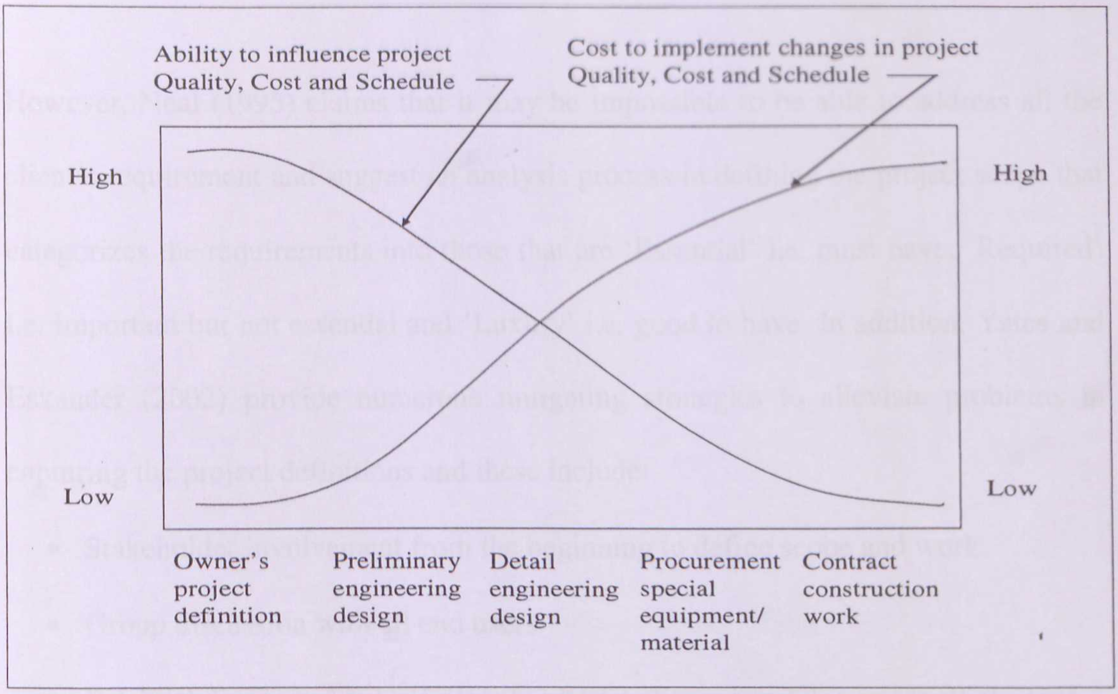


Figure 2.33: Importance of clear project definition during the early phases of project

Source: Oberlender (1993) quoted by Yates and Eskander (2002)

Hamilton and Gibson (1996) similarly highlight the importance of project definition in a study regarding influence and expenditures at various stages of a business with similar result as in Figure 2.34.

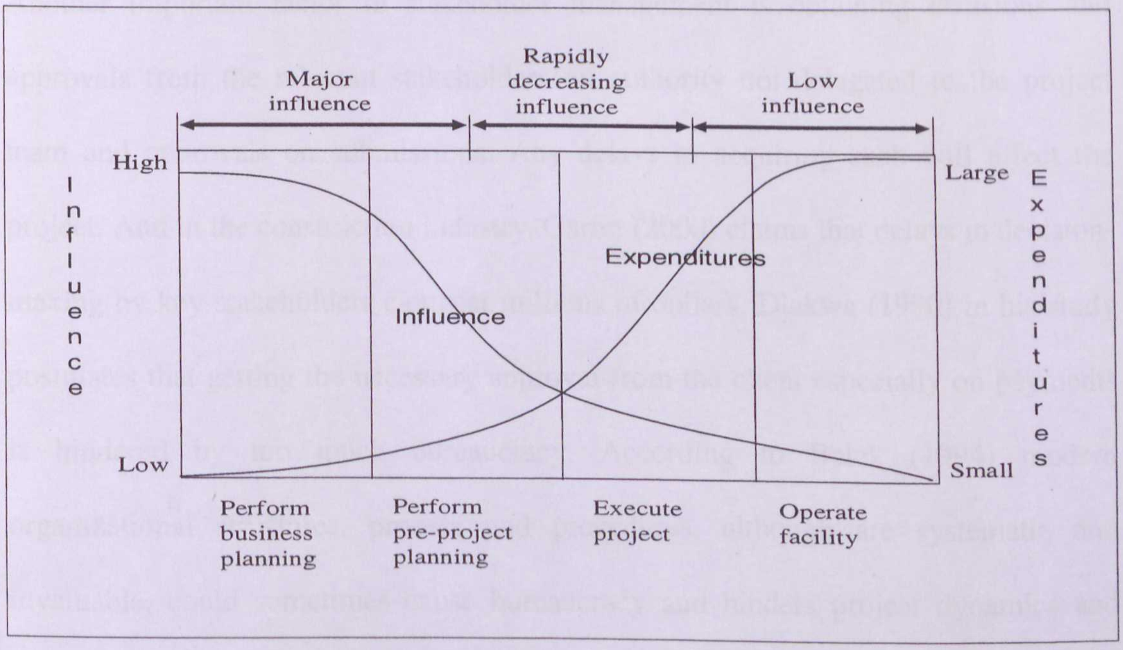


Figure 2.34: Influence and Expenditure curve for project life cycle

Source: Hamilton and Gibson (1996)

However, Neal (1995) claims that it may be impossible to be able to address all the client's requirement and suggest an analysis process in defining the project scope that categorizes the requirements into those that are 'Essential' i.e. must have, 'Required' i.e. important but not essential and 'Luxury' i.e. good to have. In addition, Yates and Eskander (2002) provide numerous mitigating strategies to alleviate problems in capturing the project definitions and these include:

- Stakeholder involvement from the beginning to define scope and work
- Group discussion with all end users
- Establish limits and cut-off dates to restrict changes and document all changes
- Clients to be informed on any cost of changes in time and money
- Clients to be informed of status of schedule with additional helpful information
- Provide a specific time frame for any decision required of the client
- Provide options for decision to be made and assist in seeking resolutions

Another important factor in stakeholder management is obtaining decisions and approvals from the relevant stakeholders on authority not delegated to the project team and approvals on submissions. Any delays in acquiring such will affect the project. And in the construction industry, Garret (2000) claims that delays in decision-making by key stakeholders can cost millions of dollars. Dlakwa (1990) in his study postulates that getting the necessary approval from the client especially on payments is hindered by too much bureaucracy. According to Balck (1994) modern organizational structures, process and procedures, although are systematic and invaluable, could sometimes cause bureaucracy and hinders project dynamics and cause disruption of the progress and eventual delay in the completion of the project.

2.7.4 Process

The next success factor group as highlighted in the proceeding literature review is with regard to process. The factors that comprise process are:

a. Planning
b. Scheduling
c. Monitoring and control
d. Quality management
e. Risk management

The success factors grouped under process that affect the project success identified by various authors are tabulated as Appendix 5.

(a) Planning

The literature and deliberation on 'Planning' comprise the following:

- Planning on how, when and who to execute the project
- Project Plan
- Project charter
- Review of plan upon any deviation
- Anticipation of problem or troubleshooting

A plan serves as a gameplan (Easton and Day, 1981, and Kliem and Ludin, 1992) or blueprint (Launi, 1999) or roadmap (Hamilton, 2003) and direction of the project (Hayes, 2000) on how to initiate, sustain and terminate a project (Cleland, 1999). Planning is thinking ahead prior to project execution to answer the questions of 'What, Why, When, How, Where and Who' (Frigenti and Comninos, 2002).

Cleland (1999) states that planning is the important part of 'deciding' prior to the implementation and it is the thinking through and making explicit the objectives, goals and strategies necessary to complete the project. It is the most time consuming phase but the end-result is worth the time spent (Spinner, 1997). Hartman and Ashrafi (2004) claim that it is widely accepted that one of the major causes of project failure is due to poor project planning.

According to Dvir et al (2003), while planning may not guarantee project success but the absence or lack of planning is a definite guarantee of failure. However, Barnes and Wearne (1993) forewarn the negative impact of inadequate or even excessive planning. Too little planning and the project team will be ill-equipped to face the assault of uncertainties but too much planning and the project team will be confused and subsequently the plan will be ignored.

Clark (2001) emphasizes the importance of planning and quotes Napoleon Bonaparte who said 'Plans are nothing, but planning is everything'. According to Frigenti and Comninos (2002), planning forces or compels the project team to think ahead on how to achieve the project objectives, to create measurement standard for progress and to communicate the project concept and objectives to those involved in the project. Hence, project planning will indicate the resources required namely materials, equipment, facilities, people and other resources (Michael and Stuckenbruck, 1981) and will be able to eliminate uncertainty, improve efficiency, obtain better understanding of project objectives and provide a basis for monitoring and controlling (Kerzner, 2003).

There are various levels of plans. Cleland (1999) mentions three levels of interrelated plans namely strategic plan involving the development of strategy, functional plan as guidance for the commitment of resources, and project plan to support the project objectives. Frigenti and Comninos (2002) term the three plans as strategic plan, management plan and operational plan. However, Hamilton (2003) states that all these plans are the project execution plan. Hayes (2000) concur that planning is multilevel but the flow is from general to detail as more information are generated and identified. Michael and Stuckenbruck (1981) demonstrate the hierarchy of plan as shown in Figure 2.35 and describe the plans as having three levels namely policy (top management), strategic (for reaching company goals) and operational (detailed plan for getting the job done).

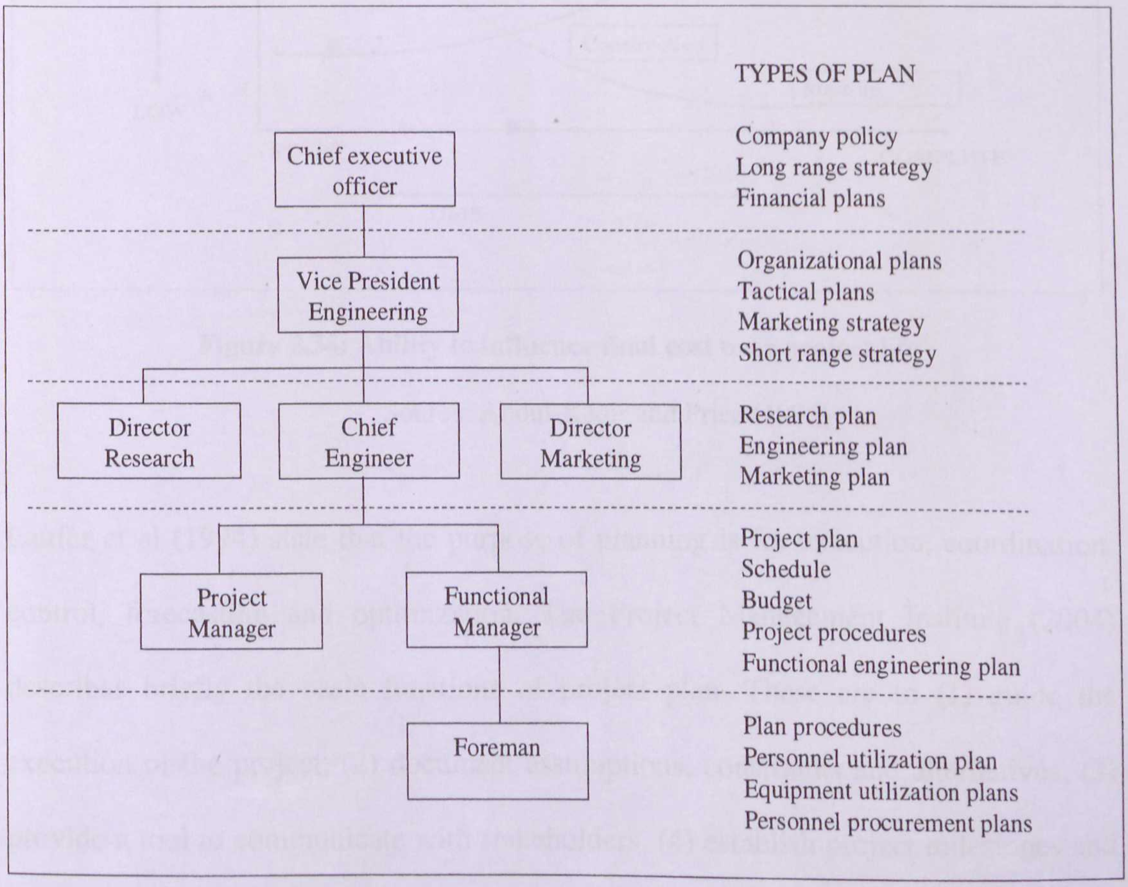


Figure 2.35: A hierarchy of plan

Source: Adapted from Michael and Stuckenbruck (1981)

Planning upon the inception and prior to the execution of a project has the most influence on the outcome of the project. Abdul-Kadir and Price (1995) reiterate the importance as according to them, the success of each phase of a project life cycle depends on what has been planned during the conceptual phase. As demonstrated in Figure 2.36, the early stage of the project gives the greatest opportunity to influence productivity and cost.

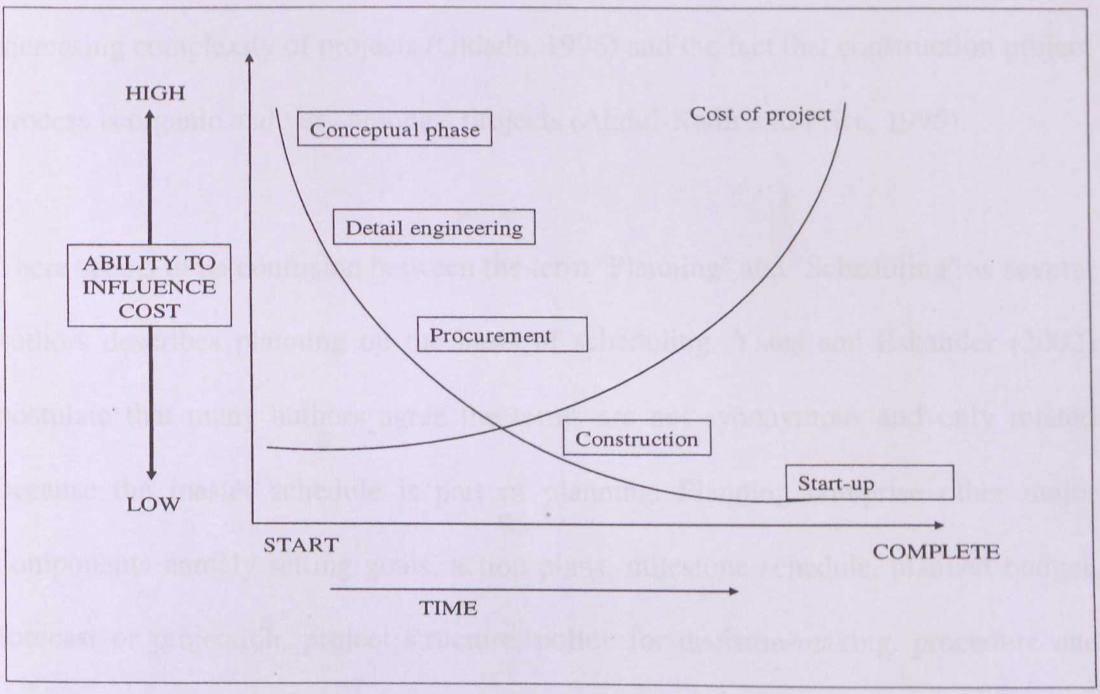


Figure 2.36: Ability to influence final cost over project life

Source: Abdul-Kadir and Price (1995)

Laufer et al (1994) state that the purpose of planning is for execution, coordination, control, forecasting and optimization. The Project Management Institute (2004) describes briefly the basic functions of project plan. These are to (1) guide the execution of the project, (2) document assumptions, constraints and alternatives, (3) provide a tool to communicate with stakeholders, (4) establish project milestones and deliverables, and (5) set scope, cost and schedule baselines for progress measurement and control.

Since the project plan provide the framework for the execution of the project, Hayes (2000) contend that the plan must be comprehensive and intelligently prepared by experienced personnel and communicated to all the project team members including relevant stakeholders who then should be committed to the plan. As a project is unique and a special task, it may be difficult to forecast or plan on what activities are required to be undertaken. Thus planning at the early stage of a project is difficult due to project uncertainties (Kolltveit and Gronhaug, 2004), ambiguity (Yeo, 1995), increasing complexity of projects (Gidado, 1996) and the fact that construction project process is organic and vary amongst projects (Abdul-Kadir and Price, 1995).

There seems to be confusion between the term 'Planning' and 'Scheduling' as several authors describes planning on the basis of scheduling. Yates and Eskander (2002) postulate that many authors agree the terms are not synonymous and only related because the master schedule is part of planning. Planning comprise other major components namely setting goals, action plans, milestone schedule, planned budget, forecast or projection, project structure, policy for decision-making, procedure and performance standard (Kezner, 2003 and Laufer et al, 1994).

According to Yates and Eskander (2002), in the construction industry, there is no standardized project planning development system, method or procedure practiced by the public and private sector. However, there have been various templates on what should be the content of a project plan. In developing their own project planning framework that they term as 'SMART' (strategically managed, aligned, regenerative and transitional), Harman and Ashrafi (2004) contend that the key element of project planning is 'to plan based on how people manage rather than obliging project teams to try to manage the way people plan'.

Typical topics covered in a project plan vary from general to detail. Spinner (1997) suggests the project plan as a simple planning diagram comprising the objectives and milestones, work breakdown structure, project activities and project planning diagram. Michael and Stuckenbruck (1981) propose a comprehensive content that include project summary, specifications, work statement, master schedule, procedures guide, budgets and cost control system, activity network plan, materials and equipment forecast, cross-impact matrix, project organization chart, management plan, project personnel plan and reporting and review procedure.

Frigenti and Comninos (2002) state that the project plan must be robust, well thought through and capable of being managed for the project to be viable. They construct a viability aspects of a project plan namely questions comprising the elements of time, resources, cost and financial to be addressed in preparing a project plan as shown in Table 2.22.

Table 2.22: Viability aspects - Questions to be addressed of a project plan

Time	• What is the shortest time in which the project can be completed? • In what sequence will the activities (work) be executed? • What work can be done simultaneously? • How long will each work package take? • Which activities are critical (that is, if delayed will affect the end date)?
Resource	• What resources will be needed? • What are the optimum levels of the required resources? • When will the resources be required? • What alternative resources can be used?
Cost	• How much will the project cost? • Are the costs within any given cost constraints? • Is the plan effective in its use of money?
Financial	• Can we afford to do the project now? • What demands will the project make on the resource of money? • What funding is required and by when? • How will money flow into and out of the project over its duration?

Source: Frigenti and Comninos (2002)

Based on the nine knowledge areas as advocated by the PMI, Globerson and Zwikael (2002) tabulate the various planning processes and major output from the processes (Table 2.23) that includes project plan, work breakdown, schedule, budget, quality management plan, and team organization.

Table 2.23: Major products of each planning process

Knowledge area	Planning processes	Major product
Integration	Project plan development	Project plan
Scope	Scope planning Scope definition	Project deliverables Work breakdown structure
Time	Activity definition Activity sequencing Activity duration estimating Schedule development	Project activities PERT or Gantt chart Activity duration estimates Activity start and end dates
Cost	Resource planning Cost estimating Cost budgeting	Activity required resources Resource cost Time-phased budget
Quality	Quality planning	Quality management plan
Human resources	Organizational planning Staff acquisition	Role and responsibility assignments Project staff assignments
Communications	Communications planning	Communications management plan
Risk	Risk management planning Risk identification Qualitative risk analysis Quantitative risk analysis Risk response planning	Risk management plan Risk list Project overall risk ranking Prioritized list of quantified risks Risk response plan
Procurement	Procurement planning Solicitation planning	Procurement management plan Procurement documents

Source: Globerson and Zwikael (2002)

Michael and Stuckenbruck (1991) summarize a comprehensive output that could be derived from a project plan as shown in Figure 2.37. The outputs of a project plan comprise amongst others, the client requirements, project team organization, schedules, budget, responsibility matrix, work breakdown structure, procedure manuals, standard practices and feasibility study, if any.

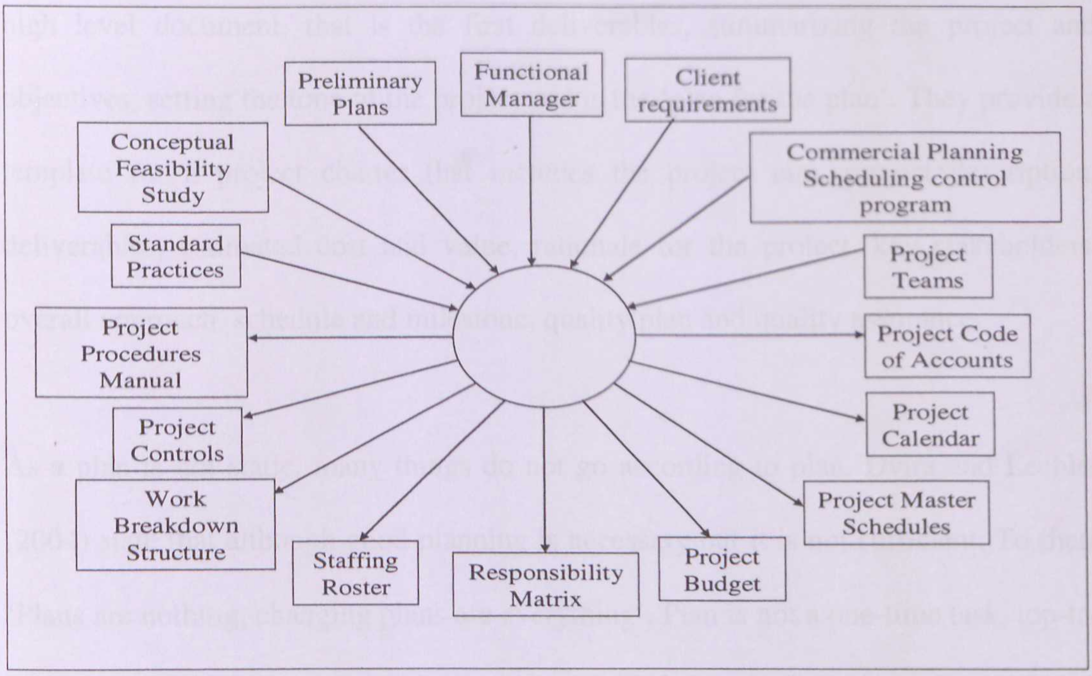


Figure 2.37: Comprehensive project plan output

Source: Michael and Stuckenbruck (1991)

However, a comprehensive project plan would not necessarily be an effective project plan. Faniran et al (1994) study the characteristics of planning efforts by construction firms. They postulate that the factors that have a major impact on the effectiveness of the project plan are sufficient time to develop the plan before commencement of the works, thorough planning to identify and determine the most efficient method of construction including alternatives, and review of the project plan during progress of work as required based on current situation.

The Project Management Institute (2004) advocates the development of project charter to be included in the planning at the inception of a project. The project charter is the commitment and support of top management to the project as it is a form of delegation of authority to the project team (Easton and Day, 1981). The importance of the project charter is highlighted by Nokes and Kelly (2007) as they describe it as a high level document, that is the first deliverables, summarizing the project and objectives, setting the tone of the project and is the 'plan for the plan'. They provide a template for a project charter that includes the project aim, project description, deliverables, estimated cost and value, rationale for the project, key stakeholders, overall approach, schedule and milestone, quality plan and quality assurance.

As a plan is not static, many things do not go according to plan. Dvira and Lechler (2004) state that although good planning is necessary but it is not sufficient. To them 'Plans are nothing, changing plans are everything'. Plan is not a one-time task, top-to-bottom process (Frigenti and Comninos, 2002) as it requires changes and contingencies must be developed (Kerzner 2000). Goals and situation changes and hence the project team must be able to respond to these changes (Kliem and Ludin, 1992). Pinto and Slevin (1994) observe that as plan will inevitably deviate due to uncertainties and assumptions made during the initial planning stage, contingency plan, systems or procedure must also be in place. They term this as 'troubleshooting' to ensure that the project team will be able to deal with any unexpected crises and divergence from the plan. Barnes and Wearne (1993) term it as 'fire-fighting' and this include foreseeing potential changes or deviations, anticipation of problems and having the options to the plan.

Dvir (2005) highlights another aspect of planning constantly neglected that is the termination plan for the transfer of the project to the project final user. The plan is to ensure effective and efficient delivery and acceptance of the project to the client, preparation of final report, reassignment of personnel, materials, equipment and other resources, assignment of maintenance responsibility and other aspects that are relevant.

(b) Schedule

The literature and deliberation on 'Schedule' comprise the following:

- Assessing the duration
- Work Breakdown Structure
- Network planning

'Time' is one of the criteria in the assessment of project success. In fact, for the construction industry, completion of project on time is considered an indicator of efficiency (Chan and Kumaraswamy, 1997). However, Nowicki (1996) claims that few engineering projects completed on time. According to Chan and Kumaraswamy (1997), delays in construction project, mostly happen during the construction phase as this is the period where most unforeseen factors are involved and uncertainties occurred. The delay is critical as it involved at least two contracting parties and any delay involves damages in terms of either financial or time.

As such, a more-efficient approach is to ensure that a realistic project schedule is prepared as early as possible. Pinto and Slevin (1994) state that the schedule must be a well-laid-out and detailed specification of the individual sequential steps that also scheduled the vital resources of man, money and material. Kumaraswamy and Chan (1995) construct a model that demonstrates the factors affecting the construction project durations as shown in Figure 2.38 These factors include the type of construction, location of the project, client's priorities, budget, productivity factor, type of contract and post-contractual developments.

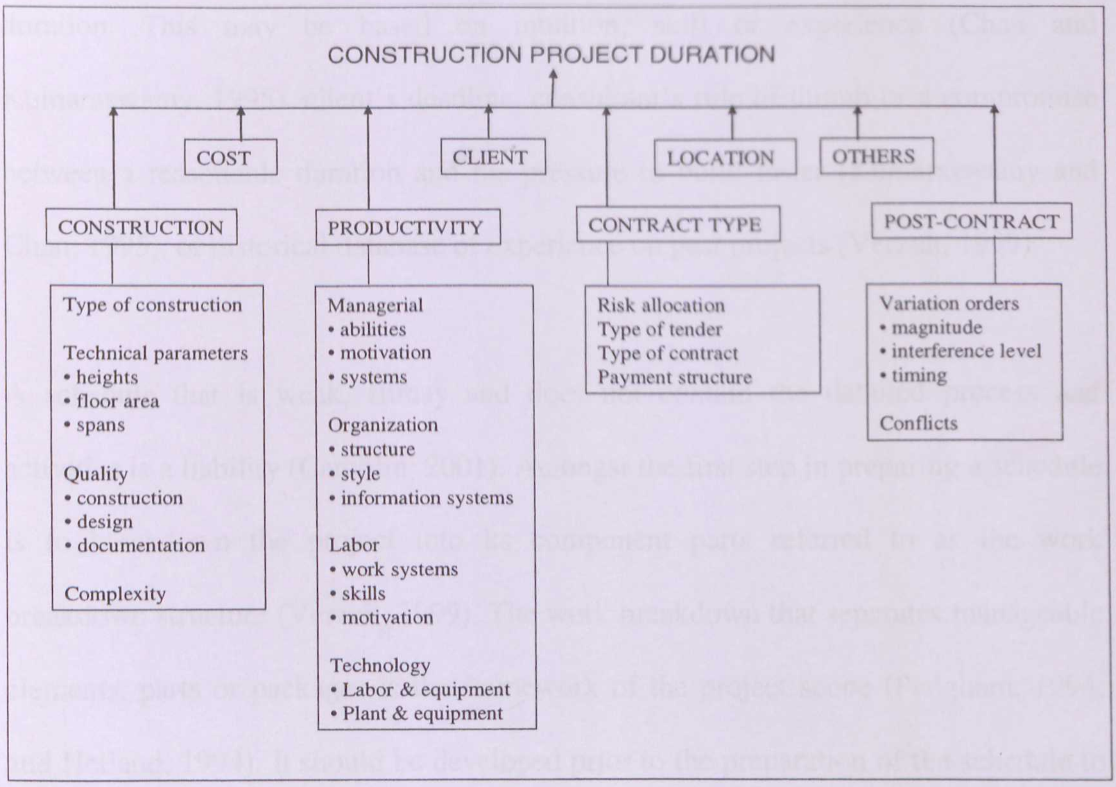


Figure 2.38: Some factors affecting construction project duration
Source: Adapted from Kumaraswamy and Chan (1995)

Scheduling software system and programming techniques have been created to assist in formulating a reasonably reliable estimate of the duration of construction project and these scheduling techniques range from simple bar chart to complex precedence diagram (Gareis, 1994). Goldratt (1977) emphasizes that numerous project-management software tools, data management systems, team-training programs, and 'best practices' have been used in the effort to program the work activities effectively.

However, based on a sample survey in Hong Kong's construction industry by Chan and Kumaraswamy (1995), they observe that despite the abundance of scheduling and programming software, formulating a reliable estimate of the duration is still a common weakness. It seems that each organization has some kind of in-house standard time norms and guidelines as the initial first-order assessment of project duration. This may be based on intuition, skill or experience (Chan and Kumaraswamy, 1995), client's deadline, consultant's rule of thumb or a compromise between a reasonable duration and the pressure to build faster (Kumaraswamy and Chan, 1995), or historical database of experience on past projects (Verzuh, 1999).

A schedule that is weak, flimsy and does not contain the detailed process and activities is a liability (Camblin, 2001). Amongst the first step in preparing a schedule is to breakdown the project into its component parts referred to as the work breakdown structure (Verzuh, 1999). The work breakdown that separates manageable elements, parts or packages is the framework of the project scope (Padgham, 1994, and Hetland, 1994). It should be developed prior to the preparation of the schedule to ensure all tasks and activities that comprise the scope of the project are taken into account (Lewis, 2001). Nowicki (1996) advocates what he terms as 'Rapid-application planning (RAP), an approach to develop work breakdown structure and schedule involving project team in a one-to-three day intensive brainstorming session.

The common techniques of network planning used in the construction industry to prepare an optimum project schedule is the Critical Path Method or CPM (Baki, 1998) and Project Evaluation and Review Technique or PERT (Al-jibouri, 2002). CPM is a network analysis technique used to predict project duration by analyzing which sequence of activities has the least amount of float (Frigenti and Comninos, 2002) and this critical path comprising the critical activities must be given priority on resources and management attention (Lock, 1996). PERT is an event-oriented network analysis technique used to estimate project duration when there is a high degree of uncertainty with the individual activity duration estimates (Frigenti and Comninos, 2002).

Haga and Marold (2004) note that the schedule is not only for the purpose of 'Time' as the duration affects the project overall 'Cost' and describe as the time-cost trade-off. According to Vanhoucke et al (2005), the duration in the critical path implies that the cost of each activity impact on its duration, which means that minimizing the cost, will increase the duration and vice versa. This involves two main issues which when integrate create a conflicting problem. The first issue is the 'deadline' on scheduling the activities to minimize cost to meet the set deadline. The second issue is the 'budget' on minimizing project duration so as not to exceed the budget. The combination of these two issues involves 'a generation of a complete efficient time-cost profile over the set of feasible project durations'.

Traditionally a schedule is merely a timetable for the execution of all the various tasks necessary for a project. Today the schedule is recognized as an important document to be used as a tool to plan, monitor and control project work (Karim and Adeli, 1999). During project execution one of the most important activities is the regular monitoring of the critical path activities to ensure adhering to the schedule (Jha and Iyer, 2005) as these critical path has no scheduling flexibility or zero float (Lock, 1996).

Nowadays, sophisticated scheduling models and system have been developed to not only program and schedule activities and tasks but also to provide various applications that would handle and integrate resources namely labor, materials, plants and financial costing simultaneously with time. These softwares are also being used to allocate the same limited resources for several projects concurrently (Al-jibouri, 2002). Even though scheduling techniques have advanced tremendously, the age-old problem stills remain. According to Haga and Marold (2004), despite the sophistication, the problem of time-cost trade-off still exists and remains critical.

(c) Monitoring and control

The literature and deliberation on 'Monitoring and control' comprise the following:

- Monitoring and feedback
- Control mechanism
- Project management information system
- Document control management

In brief, 'monitoring' is the collection of information of actual status of the project and 'control' is to compare this with what was planned and scheduled (Malaysia, 2008c).

The methods of undertaking monitoring are through meetings that include site meeting, technical meeting, and coordination meeting; reports that include physical progress report, financial report, and planning report; and records that include site diary and site records (Harbans Singh, 2002). Monitoring need to be done methodically and thoroughly to keep track of all the relevant project activities (Cleland, 1999) and continuously checking relevant project performance (Spinner, 1997) as the collecting, recording and reporting of these information is considered important by the project stakeholders (Frigenti and Comninos, 2002).

The control mechanisms are fundamentally to manage the project and organizational assets and this is done through physical assets control, human resources control, financial resources control, and information resources control (Harbans Singh, 2002). Control need to be done to evaluate and compare the actual results with the planned results to ensure the progress achieve the project objectives of cost, schedule and technical performance (Padgham, 1994, and Cleland, 1999). Using the gathered information, the actual performance is weighed against what has been planned and scheduled (Frigenti and Comninos, 2002), and taking corrective action to resolve any discrepancies (Lewis, 1995). It is to establish where you are as compared to where you are suppose to be and when there is a deviation corrective actions can be taken (Wysocki et al, 1995, and Lewis, 2001)

There seems to be a trend in increasing demand for accountability and performance from the project team by the other project stakeholders (Cleland, 1999 Kerzner, 2000, and Crawford and Bryce, 2003). With such expectation, it necessitates the use of proper project management techniques and approaches to assess and report project outcome (Cleland, 1999 and Kerzner, 2000) and the application of sophisticated system for controlling, monitoring and reporting of information regarding the project and its status (Crawford and Bryce, 2003). According to Sarshar et al (2002), there is evidence that the construction industry is increasingly using and deploying information technology and project management information system as a strategic tool to monitor and control projects.

Jaafari and Manivong (1998) claim that the main capabilities of the project management information system is being able to record, store, validate and integrate general and current project information and data, and easy retrieval of the information by project team members. In addition, the system is able to process, report, alert, highlight status, assess and measure impact of actions and decisions that would assess the project team in the monitoring and control of the project.

Jha and Iyer (2005) conduct an empirical study and amongst the important monitoring and coordination activities are: identify and monitor critical activities, detect and control variances on the performance of time, cost and quality, and monitor the overall functioning of the project team. Pinto and Slevin (1994) highlight the importance of establishing control mechanism as this will alert the project team of any real or potential problems the have or might occur and subsequently monitor any corrective measures taken to prevent further deviation from the plan or schedule.

Typical monitoring and control tools are either one-dimensional or multi-dimensional control system (Rozenes et al, 2006). The one-dimensional control system takes into account the progress weighed against time or the schedule and these are namely the milestone chart, Gantt charts, CPM, PERT, resource allocation, key performance indicators, S-curves and activity charts (Charette and Halverson, 1981, Wysocki et al, 1995, and Lewis, 2001,). The multi-dimensional project control system is an integrative system with an additional control mechanism of cost that monitors progress and cost against the schedule. The widely used multi-dimensional system is namely the earned value analysis (Padgham, 1994, Hetland, 1994, Frigenti and Comninos, 2002, and Rozenes et al, 2006).

Since the typical tools are relying on the reports of construction work done on site, Kaka (1999) argues that such control system is not complete. He proposes a control system using benchmark model on past project performances. The system, basing on completed projects, develops a probability modeling of the range of S-curves of the cost flow curves.

Bauch and Chung (2001) develop a software called the statistical project control tool (SPCT) to monitor cost, time and performance parameters. The tool, also using the historical project parameter data produce a set of statistical project control charts that set and establish the limits of variation of project requirements. These control charts establish the benchmark for similar successful project, and then it monitors, detects and alerts the project team on any developing deviation and variation. These tools are developed to create alarm bells to the project team to take correction action before the situation goes out of control. However, Lewis (2001) points out, simply detecting the deviation is not enough, as action needs to be taken to correct these deviations.

Formal and informal reporting procedures need to be established and meetings scheduled to ensure efficient monitoring of work and for stakeholders to be informed of the status of the project (Stuckenbruck, 1981) and to receive feedback on the progress of the project (Pinto and Slevin, 1994). The outline of a typical project status report should contain brief statements of overall progress, executive highlights of the status of the project and a summary of the status using graphic display in the form of bar charts, graphs etc (Spinner, 1997). Arora (1995) and Hartman and Jergeas (1996) highlight the importance of progress meeting as it is fast and on the spot reporting integrating all the different aspects of the project.

Garret (2000) states that one of the vital elements for monitoring and control of projects is the existence of a centralized document control system. It allows all key stakeholders quick access to information, which is a necessity in such fast-paced industry. Due to the current litigious climate of the construction industry, a well-thought-out filing system or document control system is so important that it is being compared to be as important as good engineering (Arora 1995).

(d) Quality management

International Standard ISO 9000 (2000) defines quality management as 'a system to direct and control an organization with regard to quality'. Webster (1994) states that quality management emphasizes on several concepts namely the concept of zero defect i.e. doing the right thing right the first time every time, the concept of continuous improvement, and constantly changing to maintain competitiveness in the rapidly changing environment.

Sypsomos (1997) notes that in implementing the quality system, a balance need to be maintained between 'quality meeting the requirements' and 'satisfying customer expectations' as there could exist a wide gulf due to different priorities and expectations of the stakeholders. As such, an acceptable performance levels need to be developed and agreed early in the project life cycle by all the relevant stakeholders.

The application of the quality management system in the construction industry has been around since the mid 1970s (Griffith, 2000). However according to Serpell (1999), in many countries it is of interest and given attention only a decade later due to the complexities of the construction process and the changing scenario of the procurement method. Moatazed-Keivani et al (1999) reiterate that the changing procurement method has seen several changes namely the responsibility for quality assurance transferred to the contractors, the one point responsibility of design and construction works, the difficult working environment and site conditions and the lack of monitoring and control over contractors' work in the construction industry. These changes necessitates the putting in practice the quality management system.

It seems that there are two schools of thought regarding the suitability of the International Standard IS0 9000 and the quality management system in the construction industry (Moatazed-Keivani et al, 1999). They note that several researchers have concerns over the system where the quality management system is seen to be 'stifling initiatives, increased confrontation and excess cost and paperwork' and thus is of no benefit to the stakeholders. On the other hand, the advocators argue that because the construction industry is fragmented, requiring formalized communication and documentation, the quality management system is the most effective way to overcome these predicaments of the construction industry.

Nokes and Kelly (2007) advocate the utilization of a quality system as it is 'a sensible, efficient and structured approach to a task'. According to Sohail et al (2004), studies have revealed that implementing the quality management system has improved companies' performance in terms of stock price and operating results. Moatazed-Keivani et al (1999) in their study of several firms in the construction industry conclude that the adoption of a properly designed quality management system is of benefit to the firms and offset the negative side effects. They postulate that the benefits of a quality management system include better management, work are more structured, increase awareness on quality and customer satisfaction.

Other benefits include create team spirit, create communication channels, formal and rigorous handling of documentation, speedy resolution of problems (Serpel 1999), increase in mutual trust between owner and contractor, better decision-making on site, reduce re-work due to the increase conscious on quality, improve management of changes (Sypsomos 1997), with 'maximum effectiveness and minimum bureaucracy' (Griffith 2000).

Abdul-Rahman (1996) in his study on the application of quality management system in the UK construction industry reveals that the system is not being widely practiced and this has resulted in different commitment level within the organization and also between the stakeholders which may consequently create conflicts. He suggests that the quality management system be considered as an integral part of and be incorporated within the project implementation process of all key stakeholders. The application of the system must be initiated by the clients and as a requirement to the consultants and contractors. However, the problems in implementing a quality system occur namely due to lack of commitment of site personnel, difficulties in the management of system documentation and its maintenance, lack of contractor's initiative due to the short construction period (Serpell 1999), and lack of training and direction to the team on the system (Sypsomos 1997).

International Standard ISO 9000 (2000) describe the key elements of a quality management system are identifying the requirement or needs and quality objectives, and comprising the quality plan, quality assurance and quality control. Project Management Institute (2004) identifies various tools and techniques to assist the project team in implementing the quality management system. For quality planning, these includes cost benefit analysis, benchmarking, and cost of quality; for quality assurance includes quality audits, quality planning tools and quality control tools; and for quality control includes cause and effect diagram, inspection, defect repair review, control charts, flowchart, histogram, pareto chart, run chart, scatter diagram and statistical sampling. In addition, Campbell and Baker (2007) claim that the common tools and techniques for quality plan are the cost/benefit analyses, benchmarking and cause-and-effect diagrams; the easiest tool for quality assurance is peer review; and the common method for quality control is simple inspection.

(e) Risk management

Raz et al (2002) define risk as the 'undesired events that may cause delays, excessive spending, unsatisfactory project results, safety or environmental hazards and even total failure.' According to Verzuh (1999) since risk is an uncertainty it thus needs to be managed systematically to increase the likelihood of meeting the project objectives. As such, the complex means of analyzing, evaluating and controlling these uncertainties is risk management (Baker et al, 1999).

Thevendran and Mawdesley (2004) provide a detailed definition of risk management as 'A continuously monitored integrated formal process for defining objectives, identifying sources of uncertainties, analyzing these uncertainties and formulating managerial response, to produce an acceptable balance between risk and opportunities'. It is a mechanism to manage project risks, put in place within the project plans in the event that the task does not go according to plan (Raz et al, 2002) and simulating the 'What ifs' scenario and subsequently minimizing the risks (Bender, 2004).

In the construction industry, the excitement of securing a project may leads to the optimistic view that everything will go according to plan and schedule in spite of the numerous uncertainties and the possibilities of deviations that would increase the perceived risk. Thevendran and Mawdesley (2004) claim that risk management has been in the construction industry since 1980's, and stakeholders seem to understand its importance. However, several authors have found that the application of risk management is relatively low even during the important early phase of a project (Uher and Toakley, 1999), and that it is still at its infancy stage since it is not utilized project-wide (Raz et al, 2002).

Thevendran and Mawdesley (2004) observe that the clients and construction companies rarely practiced risk management formally. According to Baker et al (1999), the construction industry seems to consider financial and technical risks relatively not important and companies are willing to undertake risky projects by organizing internally their procedures, systems and technical training to reduce risk. Risk management has not been effectively utilized because of inadequate knowledge and skill, negative attitude and mistrust of its beneficial values (Ward et al, 1991) due to lack of commitment on training, research and development and the unwillingness to retain or manage the risk (Uher and Toakley, 1999). In addition, there seems to be a lack of awareness and application to promote the understanding and effective utilization of the risk management tools and techniques (Raz et al, 2002).

Implementing risk management at the early stage of the project life cycle is advocated before the contract are in place, equipment purchased, commitments in place and reputation on the line, as managing change at the early stage is comparatively easy and rewarding (Chapman, 1997) and have a substantial effect on the final cost (Uher and Toakley, 1999). Bing et al (2004) state that establishing a risk allocation framework as early as possible is essential so that all the parties to the contract are immediately aware of their potential risks. Ward (1999) states that risk management should be a natural course of action in managing projects as resources available to manage risks are limited and these efforts need to be cost-effective.

There are a number of variations on the risk management system (Raz and Michael, 2001). Using the terms in BS 8444 (1996) the process comprises five steps namely risk identification, risk estimation, risk evaluation, risk response and risk monitoring. Others differ in the steps and terms used. There is the 3-steps of risk analysis, risk control and risk monitoring (Baker et al, 1999), or risk identification, response development and risk control (Verzuh, 1999), or risk identification, risk analysis and risk response (Uher, Toakley, 1999). There is also a 2-steps of risk analysis and risk response (Elkington and Smallman, 2002), or the 9-steps comprising define, focus, identify, structure, ownership, estimate, evaluate, plan and manage (Chapman, 1997).

However, it is evident that from the various differences in terms of the risk management process, there seems to be a general agreement on two main issues, that is, identifying the risk and responding to it. According to Raz and Michael (2001), the differences are on the level of detail and the assignment of the activities to the steps. The generic risk management comprises four core steps and these are risk identification, risk analysis, risk response and risk monitoring

In identifying risks, Raz et al (2002) point out that every project has risks that are different in nature. The commonly identified risks are business risk, procurement risk, management risk and technical risk (Elkington and Smallman, 2002), and others include financial risk, environmental risk, political risk, construction related risk, physical risk and human risk (Thevendran and Mawdesley, 2004). In identifying the risk, Ward (1999) suggests that a risk register to be developed and continuously updated while Bender (2004) develops a generic checklist of construction risks as shown in Table 2.24 that is to be modified based on specific project.

Table 2.24: Generic construction risk checklist

RISK SOURCE	DESCRIPTION OF RISK SOURCE	
	UNCERTAINTIES	CONSEQUENCES
Cost	Unreliable estimate	Financial impacts to project and opportunities are for greater profit margins or savings.
Schedule	Unrealistic schedule.	Time delays. Opportunities are available to shorten the project length.
Labor problems	Labor strength and productivity.	More expensive labor costs, quality problems. Opportunities are for increased productivity.
Project Management issues	Experience levels and cohesiveness of team.	Inefficiencies that result in higher cost, technical problems or damaged reputation. Opportunities for creativity and efficiencies.
Safety problems	Accidents.	Death or higher cost. Potential opportunities to lower insurance cost with good safety program.
Excessive change order	Changes that may cause productivity losses.	Increased cost, scheduled delay and technical performance. Opportunities to reduce scope or embellish the project.
Unforeseen conditions	Undefined underground, hidden site conditions or unknowns.	Time delay or cost escalation.
Environmental concerns	Regulatory approvals and environmental requirements.	Time delay or cost escalation.
Equipment issues	Selection of equipment and techniques and potential for equipment failure.	Increased costs and schedule. Opportunity potential for increased efficiencies.
Inflation		Material and labor price increase. Opportunity to get good loan rates.
Weather	Adverse weather.	Potential delays, costs and reduced performance.
Complexity	Level of difficulty.	Time delay, cost escalation and reduced technical performance. Opportunity for savings with modular simplified designs.
Client or owner initiated	Client's representatives or consultants overly critical or difficult to work with.	Increased cost and time.
Fire suppliers	Fire hazards from operations, vandalisms or lightning.	Impact on cost and schedule.
Quality	Poor quality and technical non-performance.	Opportunity for high quality and additional future work.
Political	Loss of support.	Opportunities to network and acquire new work.
Property loss	Loss due to theft, sabotage and vandalism.	
Design	Incomplete design.	Opportunity to work with design that considers construction aspect.

Source: Adapted from Bender (2004)

In analyzing risks, several techniques have been formulated but the most common technique used is the probability-impact matrix (Newell, 2001 and Verzuh, 1999, and Ward, 1999). It is the analysis of the likelihood or the probability of the risk happening and the impact it would have on the project which would determine the severity of the risk. The probability is normally determined as 'likely' or 'not likely' to happen and the impact is determined as 'low', 'medium' or 'high' and the risk rating is scored by multiplying the impact score with the probability score. Ward (1999) points out the difficulty in ranking the risk in relation to the expected impact and the probability of occurrence and usually these decisions are based on judgment, experience and the policy of the company. In responding to the risk identified and analyzed, Baker et al (1999) compile the generic response as indicated by other authors as shown in Table 2.25.

Table 2.25: Risk response

RISK RESPONSE	EXAMPLES OF ACTIONS TAKEN
Risk elimination or risk avoidance	• Tendering a very high bid • Placing conditions on the bid • Pre-contract negotiations on allocation of risks • Not bidding on high-risk portion of the contract
Risk transfer	• Hire a subcontractor to work on a hazardous process • Financial risk transferred i.e. insurance
Risk retention	• The risk are controlled and financed by the company
Risk reduction	• Improvement of the company's physical, procedural and educational, and training devices to reduce the risk.

Source: Adapted from Baker et al (1999)

In a survey conducted by Baker et al (1999), the result shows that the most favored risk response technique is risk reduction followed by risk transfer. The result also shows that in applying the risk transfer, the most common method is the insurance and indemnity clause. This is similar in construction, oil and gas, and other industries.

2.7.5 Organization

Another success factor group as highlighted in the proceeding literature review is with regard to organization. The factors that comprise organization are:

a) Organization structure

b) Financial resources

c) Policy and strategy

d) Learning organization

e) External environment

The success factors under organization that affect the project success identified by various authors are tabulated in Appendix 6.

(a) Organization structure

The literature and deliberation on 'Organization structure' comprise the following:

- Philosophy, power and politics of the organization structure
- Clear authority, delegation and responsibility
- Functional managers support
- Top management support or project champion
- Organizational maturity

According to Boddy and Paton (2004) within the organizational context, three elements are identified to be significant namely the organizational structure, culture and distribution of power.

Typical organizational structures for the implementation of a project are the functional organization, project organization and the matrix organization (Cleland and King, 1983, and Alsene, 1998). As every project is different, it is not possible to assert exactly which organizational structure is best suited for the project. However, Salapatas (1981) and Kerzner (2003) claim that for very complex project and with large number of projects running concurrently, the matrix organization is preferred. A study by Helene (1986) reveals a mixed reaction towards matrix organization. It was opined as cumbersome, imposing dual authority with power struggle and reduced motivation; while on the other hand it was also said to be flexible, provide technical quality and develop individual capabilities. Further studies suggest that the type of organizational structure that exists shows a higher percentage of matrix organization structure (Gobeli and Larson, 1987, and Sofian, 2003).

However, Jelinek (2004) claims that it does not matter which type of organization structure is used. A powerful and efficient organizational structure is one that has a clear line of responsibility, tools and procedures, and authority. A clear line of responsibility enable coordination of all the team members but flexible enough to realize and use each of their skills. The tools and procedures enable control on the project's progress and the plans to react rapidly to problems. In addition, having enough authority will minimize bureaucratic procedures.

Similarly, Lewis (1995) states that a formal structure must clearly indicate the level of authority, responsibility and accountability. Lock (1996) agrees when he postulates that any organizational structure is effective as long as there is a clear line of authority and members of the project are aware of their responsibilities. To assist in the selection of the organizational structure, Lock (1996) prepares a table as shown in

Table 2.26. It provides sets of circumstances and nature of the project that is suitable for either project organization or matrix organization.

Table 2.26: Project team versus matrix organization

CHARACTERISTIC	ORGANIZATION	
	TEAM	MATRIX
Maximum authority for the project manager	X	
Freedom from duplicated or ambiguous lines of command	X	
Maximum motivation of staff to meet difficult time and cost targets	X	
High security project	X	
Large project employing many people for a long time	X	
Most effective availability, company-wide, of expert with specialist skills		X
Several projects, each needing a few people for a short time		X
Career motivation of individuals		X
Provision of advice or service to construction personnel on site (which may prove difficult to arrange if a team has been disbanded)		X
Establishment of information banks, in which accumulated experience can be kept for retrieval on later projects		X

Source: Adapted from Lock (1996)

Ford and Randolph (1992) identify several variables that affect the effectiveness of the organization. One of these variables is organizational characteristics that include the culture of the organization. Organizational culture is defined as 'the environment of beliefs, customs, knowledge, practices and the conventional behavior of a particular social group….and they are a set of principles and standards to live and work by' (Cleland, 1988) or 'the way we do things around here' (Gray, 2001). These principles, standards or ways are important as it unites everybody within the organization (Cleland, 1988) and have a significant effect on the achievements of the organization (Andersen, 2003).

Gray (2001) states that the organizational climate or the atmosphere perpetuated within the organization or 'what it feels like to work there' must be conducive enough to create an environment that support and induce optimum performance. Dey (1999) further postulates other characteristics that affect the performance of an organization that include degree of delegation, hierarchy, decision-making process, empowerment, autonomy, flexibility and adaptability.

Bollinger (1986) notes that in setting and maintaining an organizational structure, the reporting relationship, rights and obligations of the personnel must be clearly defined. In addition to the reporting and authority relationships, Thamhain and Nurick (1994) postulate that it should be further clarified by having a responsibility matrix task list stating the project task and corresponding personnel responsible for the tasks and a job description for the project personnel that include the reporting relationship responsibilities, duties and typical qualifications. As such, according to Rad and Levin (2003), the organizational structure although need to be fixed and firm but must still be friendly and flexible enough to support unavoidable changes in the project environment and client's expectations.

In matrix organization, it is important that a collaborative relationship be maintained between the functional or line managers and project managers (Pitagorsky 2001) to avoid power politics (Easton and Day, 1981). However, according to Stuckenbruck (1981) the structure of the matrix organization is the very reason there exist a dual or multiple managerial accountability and responsibility of the functional managers towards the project manager and the top management of the organization. This creates managerial problems as the lines of authority become blurred (Cleland and Kings,

1983) and there exist the 'pulling and tugging' of personnel between functional hierarchical superior and project manager (Alsene, 1998). According to Jonason (1971), indifference and hostility may even arise between the functional manager and the project management team with regards to the functional personnel serving the project team.

Struckenbruck et al (1981) note that the key to effective matrix organization is when it is the project manager, who has been given the project direction authority, tells the project team what to do and the functional or line manager give them support by giving functional direction authority on how to do. Jonason (1971) summarizes the different level of accountability by simply stating the project manager has 'work accountability' and the functional manager has 'people accountability'. Thus to avoid ambiguity and role conflict it is important that delegation of authority and clear line of authority be established and communicated to all involved not only within the project team but also the whole organization (Thamhain and Nurick, 1994).

In a study by Sauer et al (2001), they observe that the organizational structures of companies in the construction industry have flat structures with less than two levels between the project manager and the top management and the functional departments supporting the project teams are relatively small. They postulate that this hierarchy facilitates ready access to the decision-makers of the organization and projects managed with minimum internal conflicts and tensions.

Most successful projects enjoy top management support (Avots, 1969, Thite, 2000). However, it is often that the support is only lip service (Pinto and Slevin, 1994) as mere words and encouragement does not constitute commitment and support.

Top management support includes providing necessary resources whenever required (Stuckenbruck, 1981, Pinto and Slevin, 1994, and Thite 2000), readiness to take appropriate action to provide timely decision (Iyer and Jha, 2005), and willingness to delegate relevant and sufficient authority including decision-making authority (Easton and Day, 1981, Pinto and Slevin, 1994, Jang and Lee, 1998, and Rao, 2001). In addition, it also include the willingness to impart 'clout' to the project team (Tettemer, 1981), readiness to stand up for the project team on operational difficulties (Iyer and Jha, 2005), and having the courage to do 'battle' with others in defense of the project (Helm and Remington, 2005).

Jugdev and Thomas (2002) claim that the maturity of the organizational structure affects the level of its effectiveness. They define maturity as the knowledge-based or the 'explicit, codified practice or the know-what' of the organization. It also includes the culture of the organization that has an impact on the maturity of the organization (Cooke-Davies and Arzymanow, 2003). The concept of organizational maturity is that every organization evolves through five stages of maturity: initial level, repeatable level, defined level, managed level and optimizing level. According to Cooke-Davies and Arzymanow (2003), the effectiveness of the organization increases as it gradually advanced through the maturity stage.

However, according to Ives (2005) there is a lack of research in project management literature regarding the impact of organizational context to the achievement of project success.

(b) Financial resources

The literature and deliberation on 'Financial resources' comprise the following:

- Adequate and sufficient funding and financial resources
- Prompt payment
- Accurate initial cost estimates
- Cost management

Kometa et al (1994) in their study on clients' roles and their effect to the project found that the most important attributes are the financial stability of the client that include the clients' creditworthiness, current liabilities and current assets. Since the study did not provide a methodology to predict the extent of the client's contribution, Lim and Ling (2002) conduct a further study, which conclude that the clients' credit worthiness does have a direct impact on project success i.e. the higher the credit worthiness, the higher the likelihood of project success. The study also indicates that one of the main concerns of the project team is whether the client's financial standing is adequate to fund the project until completion.

In fact, having sufficient funds either from own fund, or having the available sources of funds and identifying methods of financing the project are the pre-requisite of anyone who are embarking on a project (Tan, 2004a). To finance a project, there are numerous forms of external funds available from the banking or financial institutions (Malaysia, 2007c) as shown in Figure 2.39.

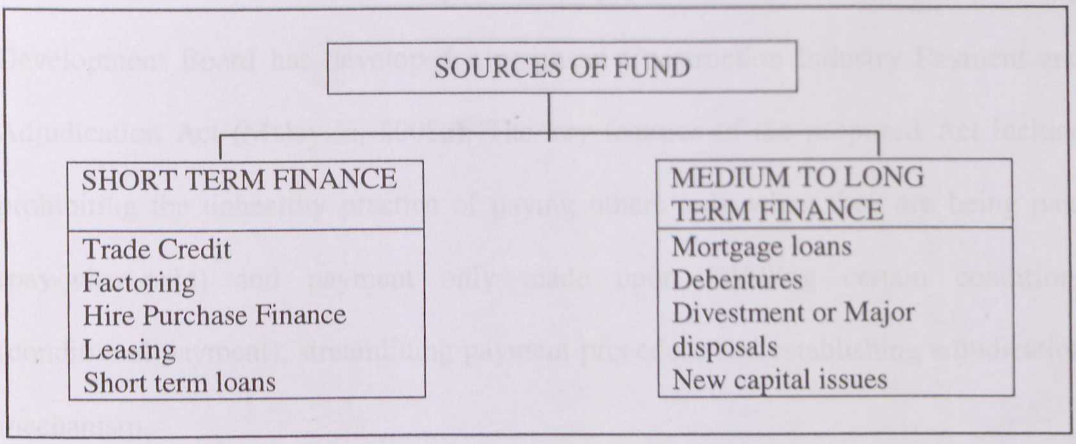


Figure 2.39: External sources of funds

Source: Adapted from Malaysia (2007c)

Another related attribute considered important is the clients' role in providing and managing the financing to ensure prompt payment to the contractor (Kometa et al, 1994). In fact, the problem of prompt payment or even non-payment has been identified as one of the ten priority areas that needs to be resolved in the construction industry (President's and CEO's Roundtable, 2003) and has been addressed as one of the strategic thrusts in the Construction Industry Master Plan Malaysia (Malaysia, 2007b)

Several studies have indicated that the major reasons for time overruns are due to financial aspects. These are delays in payment to contractors or lack of prompt payment due to bottlenecks in the client's organization and inadequate budget to make payment to the contractor which result in contractors' financial difficulties (Dlakwa, 1990), and inadequate financing and problem in payment (Odeh and Battaineh, 2002).

In the effort to overcome delays or non-payment, the Construction Industry Development Board has developed a proposed Construction Industry Payment and Adjudication Act (Malaysia, 2008a). The key features of the proposed Act include prohibiting the unhealthy practice of paying others only when they are being paid (pay-when-paid) and payment only made upon fulfilling certain conditions (conditional payment), streamlining payment procedure and establishing adjudication mechanism.

Stuckenbruck et al (1981) in their case study on construction projects note that 'the best project control system in the world won't save a bad estimate'. Studies have shown that amongst the reasons for cost overrun are deficiencies in the initial estimate (Dlakwa, 1990 and Dey, 1999). However, Nokes and Kelly (2007) note that at the early planning stage an accurate estimate is not essential as it could be refined as the project developed.

According to the Project Management Institute (2004), there are four key concept of a cost management system. It is developing a cost estimate, which is then aggregated to individual activities as cost budget that establishes the cost baseline, and lastly cost control to ensure variances and changes are controlled. However, Ferry et al (1999) describe the cost management strategy as a 3-stage system according to the phases of the project namely the initial, design and construction phases. Stage 1 comprises the cost plan where the cost of the project is estimated which is then aggregated into a cost framework. Stage 2 comprises the cost budget where the cost plan is used to control the design during the design process, which is thus termed as 'designing to a budget'. Stage 3 is cost control where the cost is controlled during the construction phase.

(c) **Policy and strategy**

The literature and deliberation on 'Policy and strategy' comprise the following:

- Strategy on stakeholder analysis
- Formulation of clear project objectives and goals
- Strategy on training provisions for personnel development
- Factors related to project i.e. size and uniqueness and realizing complexity of project

Jergeas et al (2000) stress that one of the main reasons for client dissatisfaction, project progress disruption and lack of bond between project team and stakeholders is due to the problem of unclear policy and strategy. Kamara et al (2000) also highlight its importance when they state that the framework to achieve the goals of satisfying customer and sustain competitiveness is when the objectives of time-cost-quality are achieved which are the result of well-thought policy and strategy. According to Longman and Mullins (2004), the strategy set the boundaries and future direction of the project. However, despite the importance of policy and strategy, Anderson and Merna (2003) highlight that there is a dearth of research regarding developing effective policies and strategies in deploying projects.

Lewis (2001) defines policy and strategy as establishing the framework and strategizing the accomplishment of the stakeholders' interest and project objectives into an end-result. Anderson and Merna (2003) define the term as the strategy for the management of the project at a high level to achieve the objectives of the project that set the foundation for the project plan and project objectives. Slevin and Pinto (1987) state that project success require both the components of strategy and tactical. Strategy is related to the early phase of the project implementation and tactical is concerned with the actual implementation of the project.

According to Grundy (1998) there are various diagnostic tool that could be used to assist in developing policy and strategy in project implementation namely rootcause or fishbone diagram, push versus pull strategy, force field strategy and stakeholder analysis. One of the strategic tools that should be used at the early stage of project implementation is stakeholder analysis. Grundy (1998) defines stakeholder analysis as the 'systematic identification of key stakeholders and appraisal of their influence on and posture towards implementation' and this involve strategizing on reshaping and influencing the stakeholders as shown in Figure 2.40.

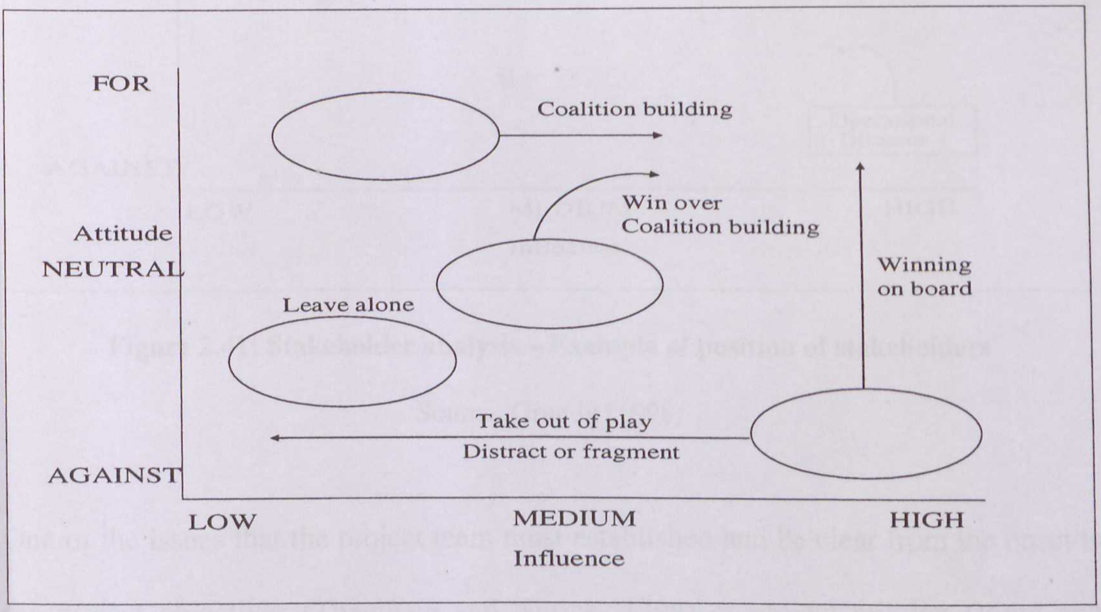


Figure 2.40: Stakeholder analysis

Source: Grundy (1998)

The stakeholder analysis model as shown in Figure 2.40 involves brainstorming to identify the key stakeholders, evaluating their influence i.e. ranging from low to high, and evaluating their attitude i.e. against, neutral or for the project. McElroy and Mills (2003) support this claim in his illustration of stakeholder analysis as one of the required strategic move. An example of a stakeholder analysis using the above template that provides a first cut on the pattern and position of the key stakeholders is shown in Figure 2.41. This will then be used to assist in developing strategies for stakeholder management.

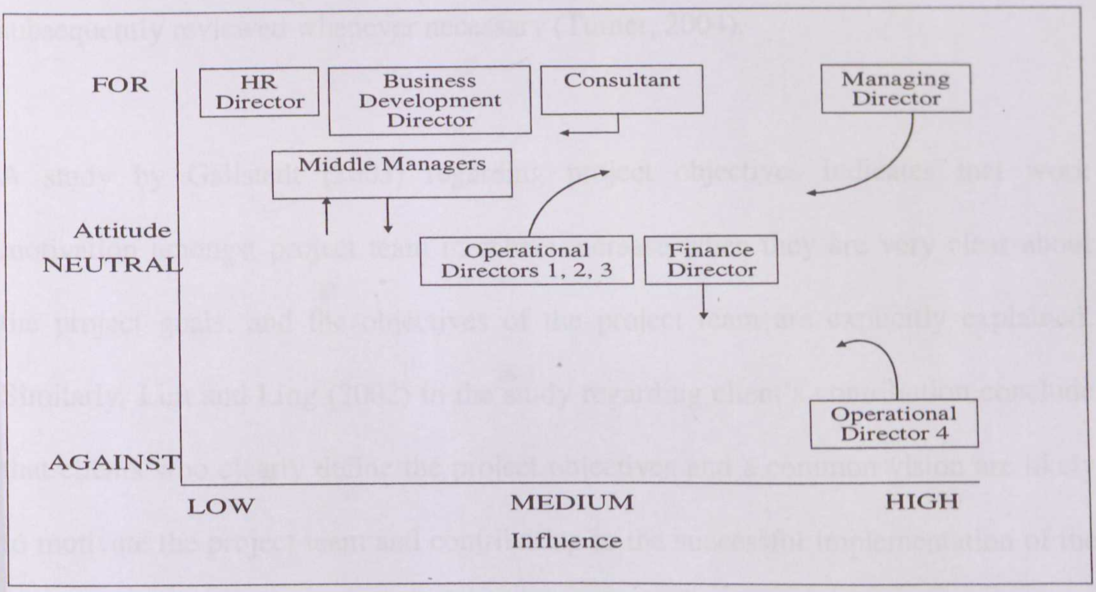


Figure 2.41: Stakeholder analysis – Example of position of stakeholders

Source: Grundy (1998)

One of the issues that the project team must established and be clear from the onset is the project objectives (Thamhain and Nurick, 1994) or project mission (Pinto and Slevin, 1989) or a single set of achievable project goals (Lim and Ling, 2002) or preferred project outcomes (Norrie and Walker, 2004). This includes any revision that need to be communicated to other involved parties to avoid conflict (Ward et al, 1991).

Pinto and Slevin (1994) stressed the importance of clarity of project goals and objectives as they set the direction and what the project is required to achieve. Skulmoski and Hartman (1999) postulate that project objectives need to be identified, documented and prioritized and all key stakeholders are aligned with the project goals and objectives. Zika-Viktorsson et al (2003) state that project goals are the reasons for the procurement of a project and the project objectives set the stage for how the project is organized. And these project objectives and goals are required to be formulated and agreed with the key stakeholders at the start of the project and subsequently reviewed whenever necessary (Turner, 2004).

A study by Gallstedt (2003) regarding project objectives indicates that work motivation amongst project team members increase when they are very clear about the project goals, and the objectives of the project team are explicitly explained. Similarly, Lim and Ling (2002) in the study regarding client's contribution conclude that clients who clearly define the project objectives and a common vision are likely to motivate the project team and contributing to the successful implementation of the project. However, the client's objectives, which are normally the time-cost-quality objectives must not only be clearly set but trade-off between these objectives is thoroughly analyzed (Ward et al, 1991) and prioritized (Lim and Ling, 2002).

Another policy to be considered involved establishing a continuous training program as a strategy to develop the personnel in the project team (Bolliger, 1986 and Schultz, Slevin and Pinto, 1987, Henri-Charles, 1995, and Nathan, 2008). A study by McCreary (2003) indicate that training, especially project management simulation training exercise, improve the level of knowledge and also the ability on application of the knowledge among the participants. These programs are not to be confined only on technical matters but also management issues and team building to promote esprit de corps. Barnes and Wearne (1993) state that training should no longer be only focused on the brick-and-mortar issues but rather the principles, judgment, persistence and soft issues that they believe would increase the intelligence and effectiveness of the project personnel. The training also includes issues with regard to familiarization of the client's culture especially for international projects (Ling et al, 2006). Bolliger (1986) highlights instances where failures of several projects were not due to technical shortcomings but due to inadequately trained personnel.

Factors related to project namely the size, uniqueness, complexity and uncertainty will ultimately influence and determine the policy and strategy of implementing the project (Bennet, 1983, Bennet and Ormerod, 1984, Kometa et al, 1994, and Belassi and Tukel, 1996). Dey (1999) offers a reason stating that the size of the project would have an impact on project outcome due to the multiplying effect of problems and uncertainties, which increases with size. He claims that one of the prominent causes of cost and time overrun is due to the project size and complexity.

Ford and Randolph (1992) in summarizing the literature by several authors on the characteristics of a project, state that a bigger project will be more complex, comprising large number of varieties of tasks that are changing in a rapid pace involving larger amount of cost and time and are more difficult to integrate. Urgency of the project is another factor that will has an impact on the success rate. Due to time constraint, there is no proper policy and strategy and insufficient time allocated for execution that most likely will result in project failure (Belassi and Tukel, 1996).

(d) **Learning organization**

The literature and deliberation on 'Learning organization' comprise the following:

- Learning organization
- Learning from experience
- Capturing lessons learnt
- Organizational learning

Learning theorist Senge (1990), an author who have been most quoted by others on the subject of learning organization define learning organization as being one that is continually expanding its capacity to create its own future. Ayas (1996) describes learning organization as an organization that encourages and is continually engaged in the process of learning, communicate their learning to other staff and the knowledge that is being accumulated is embodied within the organization. George and Jones (1999) highlight the importance of an organization adopting a learning mentality where initiatives are taken to act upon lesson learnt or new ideas and knowledge that are then shared throughout the organization.

Cooke-Davies (2002) describes learning organization as 'an effective means that combines explicit knowledge with tacit knowledge in a way that encourages people to learn and to embed that learning into continuous improvement of project management processes and practices'. Dai and Wells (2004) describe the term as transferring of lessons that could be learn from past projects to influence the outcome of future projects.

Senge (1990) highlights five essential organizational behaviors that are key to achieving a learning organization that is encourage high self-efficacy, develop schemas to understand work activities, encourage learning in groups, communicate a shared vision for the organization, and encourage system thinking.

The necessity of learning through experience is to share the tacit knowledge embedded in the personnel involved in projects and adapt the experience as best practice (Carrillo et al, 2004). Even in failure, there will always be lessons to be learnt (Volckmann and Knutson, 2001). Turner et al (2003) highlight the importance of experience, even bad experience, by stating, 'Experience is the raw material of learning and knowledge creation'. And these experiences are to ensure no repetition of past mistakes that cause project to fail (Forsberg et al, 2000), and for the organization to compare the most effective problem solving mechanisms and to reduce project risks as mishaps, mistakes and pitfalls could be avoided (Schindler and Eppler, 2003). As described by Longman and Mullins (2004), every project is a stage set for learning, advancement and building capabilities.

However, it is common that at the end of a project, the personnel involved with the project either left the company or assigned to other projects and the specific experience of that project will be lost. Schindler and Eppler (2003) describe this phenomenon as project or organizational amnesia. Thus, having the experience alone without capturing those lessons learnt are not enough as the organization as a whole will not benefit. Capturing both good and bad experience and documenting them as lessons learnt are one of the best post-project review techniques (Pinto and Kharbanda, 1996) and the task of capturing lessons learnt is termed as 'systematic retention of project experiences' (Schindler and Eppler, 2003).

Pinto and Kharbanda (1996) claim that organizations repeat their mistakes on projects because they did not capture the learning experience on past projects, fail to expose personnel on those lessons learned within the organization and did not encourage project team to document their experiences for future reference. A study by Love et al (2003) in the Australian construction industry reveals that most of the firms have a low to moderate learning capability. They point out that although some firms implement project reviews, others are more inclined to encourage individual learning and not organizational learning practices.

Turner, Keegan and Crawford (2003) cite the Kolb's experiential learning cycle to demonstrate the role of experience in learning as shown in Figure 2.42.

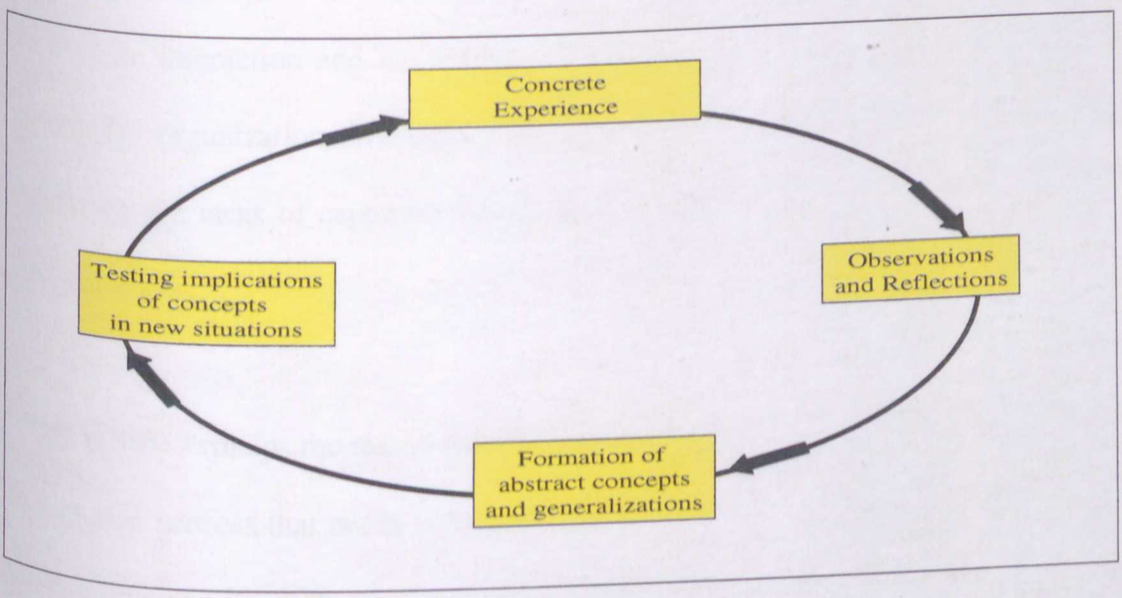


Figure 2.42: Kolb's experiential learning experience

Source: Turner et al (2003)

To capture the lessons learnt from the experience of past project requires a mechanism or process to be set-up within the organization. Schindler and Eppler (2003) point out that there is evidently a gap between the actual experience happening and the project debriefing. This gap is due to lack of method for project-centred gathering to retain the project insights and subsequently a lack of ways of using these lessons learnt.

Although most organizations are aware of the significance and benefit of lessons learnt, there is a lack of mechanism or system to document such experience (Williams, 2003, Forsberg et al, 2000) and this mechanism or system is not integrated systematically as one of the organization knowledge base (Schindler and Eppler, 2003). This system would have helped the individual and the organization to convert tacit knowledge to explicit knowledge (Love et al, 2003). According to Ayas (1996), learning will not happen naturally and for it to occur a system is required to be instituted or put in-place. Duggan and Blayden (2001) state that the mechanism must include an interaction and knowledge sharing process that would facilitate learning across the organization. Williams (2003) summarizes the mechanism as a process involving the tasks of capturing the lessons, storing, disseminating and re-using for future projects.

Ayas (1996) explains the reason for this apparent lack is due to such mechanism being a complex process that needs to be consciously developed and managed and requires commitment and continuous financial and personnel investment. And these personnel must include those who participated in the project, thus requiring their personal involvement, time and commitment (Duggan and Blayden, 2001). Other reasons for the lack of such mechanism could be insufficient time, no motivation, lack of standard project review methods and past post-project review not seen to be helpful or useful (Turner et al, 2003), knowledgeable personnel assigned to other project and error in interpreting lessons learnt (Nasr et al, 2000). In addition, Williams (2003) points out that the complexity is also due to the difficulty in understanding what went wrong or right and why, discerning the easy reasons from the hard non-intuitive behaviors, deciphering the simple reflection into lessons learnt and establishing the chains of causality.

In the attempt to understand the barriers of the retention, management and transfer of knowledge and learning, Bresnen et al (2003) conduct a case study research on several construction firms. The finding of the study reveals that there exist social and technological barriers to the capturing and diffusion of knowledge. They postulate that the fragmented environments place a constraint in the effort to 'develop shared perspectives on innovation, knowledge and learning'. These constraints or barriers include the one-off nature of the project, discontinuities of information and resources across time and space, complex organizational division of labor between professional and other groups involved, difficulties of interpreting knowledge in a general context, tendency of avoiding revealing unconventional methods of resolving issues and communication barriers. In addition, Carrillo et al (2004) state that the main barrier is the lack of standard work process.

Busby (1999) states that even though the reviews of knowledge gained tend to be shallow with superficial remedies, misleading assumptions and event specifics, capturing these lessons of past projects is a necessity. It goes beyond the boundaries of the needs of future projects but even more so for the continuous improvement and subsequently sustaining the success of the organization (Ayas, 1996). Sense and Antoni (2003) add that the culture of learning through experience should extent to the whole organization and for the organization to become a learning organization not only as a competitive advantage over others but also for its long-term survival.

There are various methods of capturing lessons learnt and creating a learning organization. This include conducting end of project reviews to capture experience (Turner et al, 2003), project debriefing workshops (Schindler and Eppler, 2003) and even conducting post-failure review (Pinto and Kharbanda, 1996). Other methods include mapping technique showing the chains of causality that enable to identify the lessons from the projects (Williams, 2003), keeping simple lessons-learned files and case studies (Kerzner, 2000) and documenting reasons for variances and corrective actions (Project Management Institute, 2004) and using a project history retrieval and analysis system (Leo, 2002). Duggan and Blayden (2001) develop a five-stage strategy-based learning through a facilitated group discussion process. The stages of the learning process are: (1) Setting the boundaries and context, (2) Providing a means to capture the experience and intent, (3) Learning from the experience (4) Facilitated group discussion or workshop and (5) Putting lesson learnt to practice.

Williams (2003) review on the literature reveals various processes postulated by other researchers. This include conducting project post-mortems, record of lessons learnt at the event-level and the project-level, setting up a Post-Project Appraisal unit asking 'what happened' questions, and 'Learning Histories' a six-stage process to identify lessons from experience. Sarshar et al (2000) develop a diagnostic tool which they called Standardized Process Improvement for Construction Enterprises (SPICE) that comprise a stepwise improvement framework that initially capture the successful practices of earlier projects within the organization, standardizing such practice into a process and continuously improving the process.

(e) **External Environment**

The literature and deliberation on 'External Environment' comprise the following:

- Political environment
- Economic environment
- Technological and legal environment
- Social and Community environment

Every project works within an environment that includes political, economical, social and technological elements (Belassi and Tukel, 1996). Collis and Montgomery (1997) show graphically the approach to strategic planning using 'Strengths, Weaknesses, Opportunities and Threats' (SWOT) analysis as shown in Figure 2.43. This analysis forces the firm or the project team to analyze its strength, weakness, opportunity and threat within the various macro environments and develop a fit between its strategy and the environment.

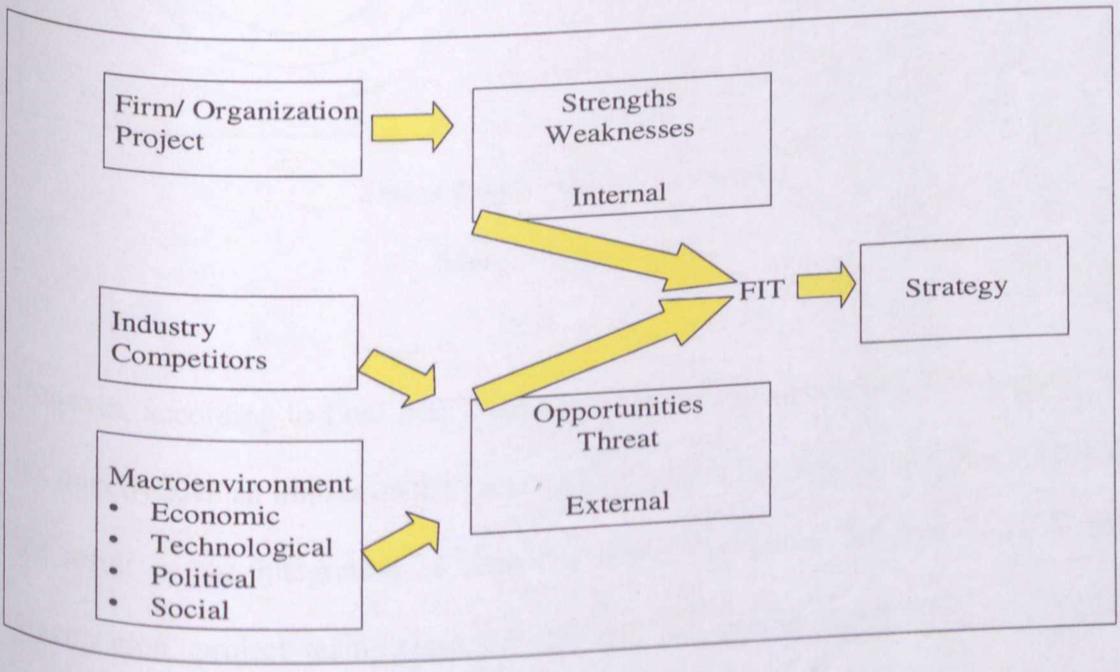


Figure 2.43: SWOT Analysis

Source: Adapted from Collis and Montgomery (1997)

According to Lopes and Flavell (1998), these environments provide some degree of interferences to the project implementation. Youker (1994) demonstrates the various external environments in Figure 2.44. These include regulators, suppliers, competitors and consumers within the geographical environment of local, regional and national. They postulate that understanding and managing the environment that would affect the project would be crucial to the success of the project.

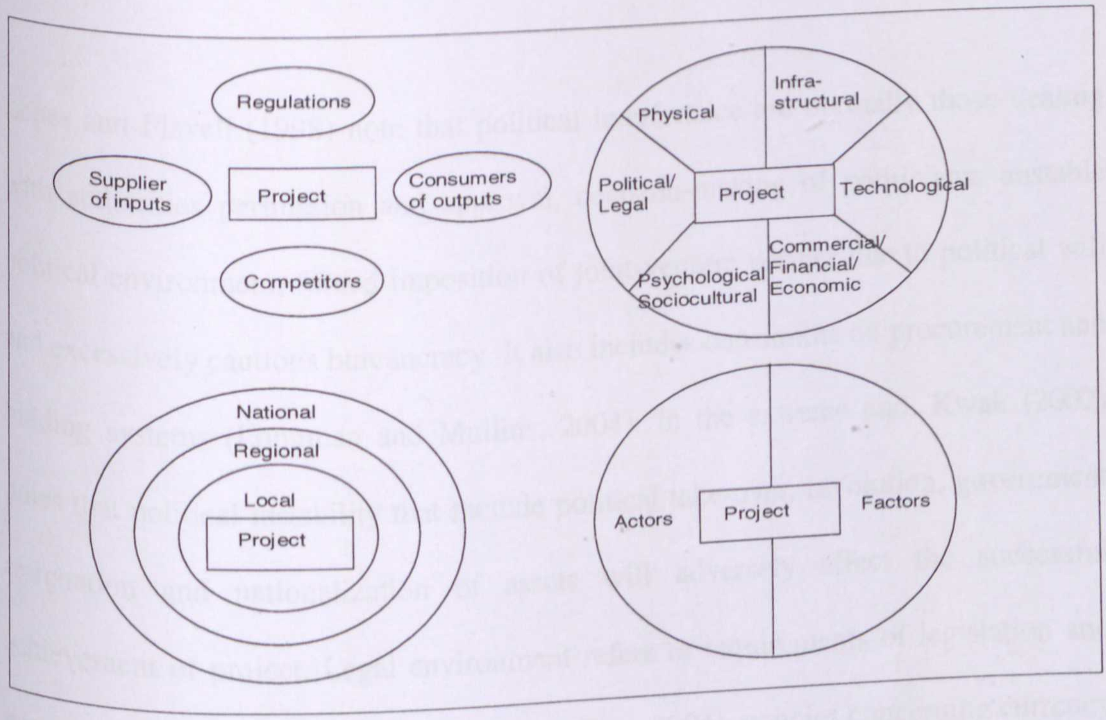


Figure 2.44: Project environment

Source: Youker (1994)

However, according to Ford and Randolph (1992), these external environments will not directly give an impact on the project effectiveness but their consequences will be the result of the integration of other variables namely the characteristics of the organization, project team, project leader and the project itself. The effective or ineffective integration of other variables in dealing with the external environment will determine whether the external environment is a risk or not.

Pandia (1994) claims that a country's economic and political stability directly contributed to the successful implementation of projects. Frequent and widespread internal strife, revolutions, turmoil and unrest will lead to a force-majeure situations and disrupt the project. Pinto and Kharbanda (1996) add that a sure route for project failure is to ignore what Cleland (1988) termed as 'intervernors' i.e. the project external environment especially political, social, environmental and consumer groups as these have a direct impact on project success.

Lopes and Flavell (1998) note that political interference are normally those dealing with authorities permission and approval, decision-making of politicians, unstable political environment, forced imposition of joint-venture partner due to political will and excessively cautious bureaucracy. It also includes constraints on procurement and bidding systems (Longman and Mullins, 2004). In the extreme end, Kwak (2002) notes that political instability that include political take-over, revolution, government resignation and nationalization of assets will adversely affect the successful achievement of project. Legal environment refers to requirements of legislation and government's regulations (Longman and Mullins, 2004), policies concerning currency conversion, taxation system, customs regulation, royalties, role of courts in arbitration proceedings and electricity tariffs (Kwak, 2002).

Environmental analysis is required to minimize damage caused by the project to the landscape, air, water or other element. Similarly, there will be impact on the implementation of the project due to the social and community environment where the risk to the project is possible delay due to social opposition or public inquiries and legal demands on environmental standards (Lopes and Flavell, 1998, and Buang, 2008).

2.7.6 Contract and Technical

The last success factor group as highlighted in the proceeding literature review is with regard to contract and technical issues. The factors that comprise contract and technical are:

a) Contracting

b) Contractor

c) Technical

d) Innovation

The success factors under contract and technical that affect the project success identified by various authors are tabulated as Appendix 7.

(a) Contracting

The literature and deliberation on 'Contracting' comprise the following:

- Procurement method
- Contract administration
- Resolution of contractual disputes

The procurement method is sometimes referred to as the contractual arrangement, procurement system or procurement routes. The procurement method for a construction project is required to be confirmed at the early stage of the project life cycle (Malaysia, 2008b). It establishes the contractual framework identifying the obligations and rights of the parties (Tan, 1996), contractual relationship allocating risks and remedies (Haapio, 2004) and the scope of work and performance required (Bently and Rafferty, 1992). It also states the key drivers of a contract namely certainty of terms, payment terms, guarantee, warranties, liabilities and securities

(Branconi and Loch, 2004). Bubshait and Almohawis (1994) present several attributes in a construction contracts namely clarity, conciseness, completeness, consistency, practicality, fairness, effect on quality, cost, schedule and safety.

There are various procurement methods that are either based on a fixed price or cost reimbursable, and time and materials (Nokes and Kelly, 2007). Lampman and Dimeo (1989) term the approach to procurement method as the traditional adversarial approach and the collaborative team approach. The common and general term for these procurement methods are traditional, package deal, and management contracts (Love et al, 1998, and Tookey et al, 2001) and privatization (Malaysia, 2008c). These are shown graphically in Figure 2.45.

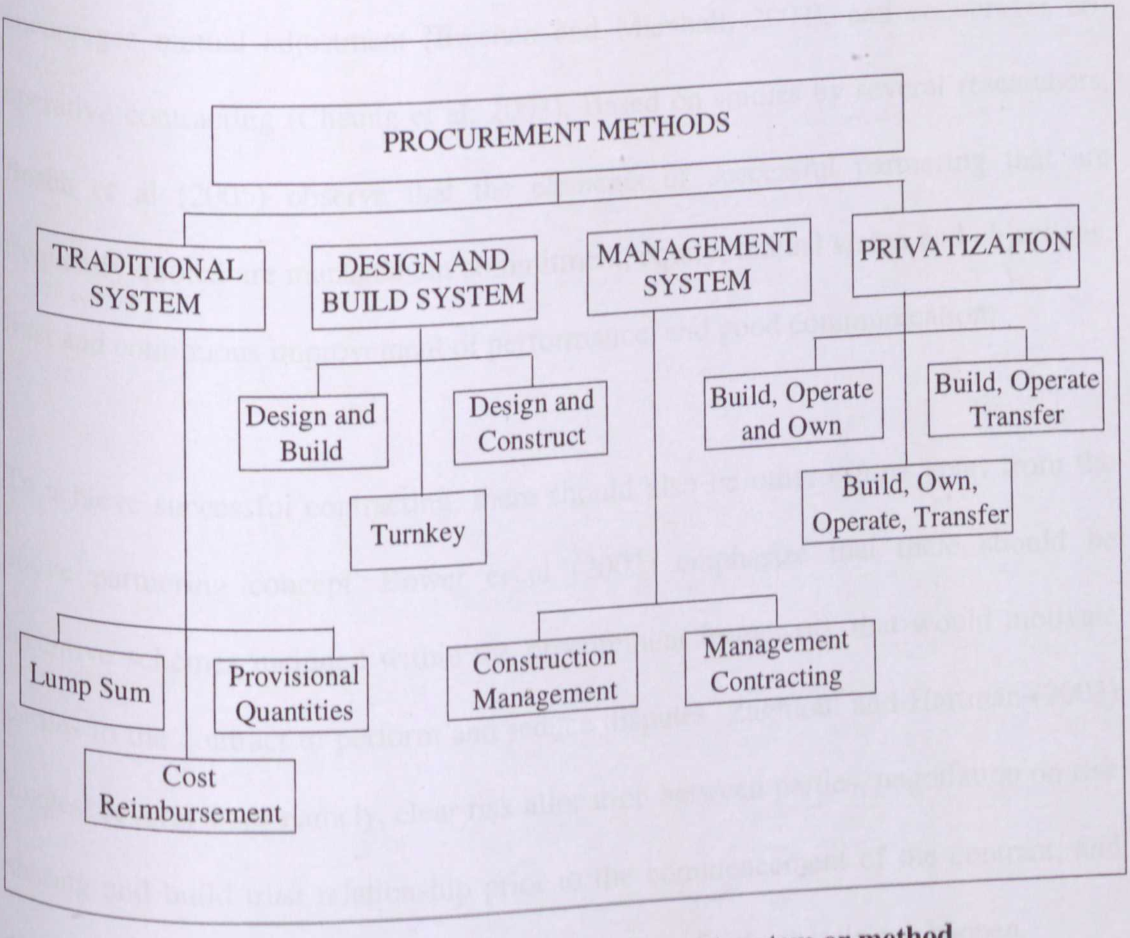


Figure 2.45: Categorization of procurement system or method

Source: Adapted from Love et al (1998), and Malaysia (2008c)

Latham (1994) and Egan (1998) propose an improvement to the procurement method by utilizing a 'Partnering' concept that would reduce confrontation between contracting parties. Black et al (2000) note that various researchers have advocated for the partnering procurement method as it encompasses three key elements that would achieve positive result. These key elements are eliminating adversarial relationship, encouraging the parties to work together, and promoting shared objectives.

Further more, partnering framework stimulates teamwork and continuous improvement (Naoum, 2003), establishes open communication (Ellis, 2002), establishes trust and channels to resolve disputes (Wong and Cheung, 2004), encourages mutual adjustment (Bresnen and Marshall, 2002), and encourages co-operative contracting (Cheung et al, 2003). Based on studies by several researchers, Beach et al (2005) observe that the elements of successful partnering that are frequently quoted are management commitment, equity, mutual vision and objectives, trust and continuous improvement of performance, and good communication.

To achieve successful contracting, there should also be other efforts apart from the above partnering concept. Bower et al (2002) emphasize that there should be incentive schemes included within the procurement framework that would motivate parties to the contract to perform and reduce disputes. Zaghloul and Hartman (2003) suggest several steps namely, clear risk allocation between parties, negotiation on risk sharing and build trust relationship prior to the commencement of the contract, and establish a risk-reward system to share any benefits of risks that do not happen.

However, even though there are several procurement methods, many researchers have agreed that a particular procurement method may be best suited for a particular project based on the feature and characteristic of the project but there is no one particular procurement method that could be termed as the best method for all projects (Love et al, 1998).

Similarly, Hashim (1999) in her study with regard to various procurement methods utilized in the construction industry in Malaysia concludes that in comparing the various procurement methods there is no one best solution that fits all. In addition, although the procurement method is not a predictor of performance but it is an important variable that would affect the performance of the project. The study postulates that the decision on the choice of the procurement method needs to take into account the client's requirements and priorities, and match against the features and benefits of the individual procurement method. The decision on the procurement method is important as Ramly (1995) states that decisions made at the early stage of any project is crucial as it affect other subsequent decisions and eventual performance of the project.

But the decision on the selection of the procurement method is confusing and difficult due to the differing variables and factors that need to be taken into consideration and each method has its own strength and weaknesses. Selecting the optimal procurement method for a particular project is a 'succession of calculated risks' (Tookey et al, 2001). Malaysia (2008b) highlights several factors that take into account the balance between time-cost-quality objectives, accountability, and market conditions.

Several studies conducted develop models and framework to assist owners in the selection of the appropriate procurement methods. Love et al (1998) construct a framework of criteria that is general for simplicity but sufficient as selection criteria with the onus on the owner to provide weightage on their preferred criteria. Kumaraswamy and Dissanayaka (1998) construct a model that link the framework of procurement options to project outcomes. Alhazmi and MacCaffer. (2000) create a software model comprising several screening processes based on characteristics of project and client, time-cost-quality requirements, and the characteristics of the various procurement methods. Al-Khalil (2002) develops a model using the analytical hierarchy process (AHP) based on four factors namely the project characteristics, owner's requirements and owner's preference which are then matched with the characteristic of the different procurement methods. A study by Sadeh et al (2000) postulate that the choice of the procurement methods is based on the level of technological certainty of the project.

Nevertheless, Hashim (1998) claims that the procurement methods selected by owners are generally based on simple and basic reasons namely familiarity and flexibility of contract, early completion requirement and top management policy. Likewise, Tookey et al (2001) find that the clients usually select the procurement method they are familiar with and modifications are made to the contract form. Although the client usually decides on the procurement method, other considerations on the selection shall be based on the degree of project definition (Ritz, 1994) and the type of project and competencies of the parties involved (Westerveld, 2003).

The administration of the contract is based on the contractual and legal basis of the type of procurement methods selected (Morris and Hough, 1987). But no matter which procurement method is used, there are generic contractual issues that can be derived for administering a contract. These contractual issues include the supervision of work progress, payment to the contractors, changes or variation works, delay to the progress, completion of work, maintenance, making good defects, and final account (Malaysia, 1994, Rajoo, 1999, Harbans Singh, 2002, and Malaysia, 2008c,). Abdullah (2008) illustrates these contractual issues graphically as contract administration flowchart shown in Figure 2.46.

The common dispute resolutions for contracts are through negotiation, mediation, adjudication or arbitration (Malaysia, 2007d). Negotiation or mediation is an amicable settlement between the two disputing parties but the decision is not binding if either party disagrees. The only difference is that mediation involves a neutral third party to be a mediator (Malaysia, 2007d). There are several mediation rules as set out in the contract (KL International Airport Berhad, 1994), or as prescribed by the industry (Construction Industry Development Board Malaysia).

Adjudication is another alternative dispute resolution that involves a final and binding decision by an adjudicator on the dispute that must be determined within a specific time (Malaysia, 2008a). Most standard forms of contract include the provision for arbitration to be held after the completion of the project and similarly the decision by the arbitrator is final and binding (Malaysia, 2007e, Pertubuhan Arkitek Malaysia, 2006, and Federation International Des Ingenieur-Counsels, 1999). The Institution of Surveyors Malaysia has initiated a handbook with regard to the conduct of arbitrators and guidelines on submitting disputes to arbitration (The Institution of Surveyors Malaysia, 1984).

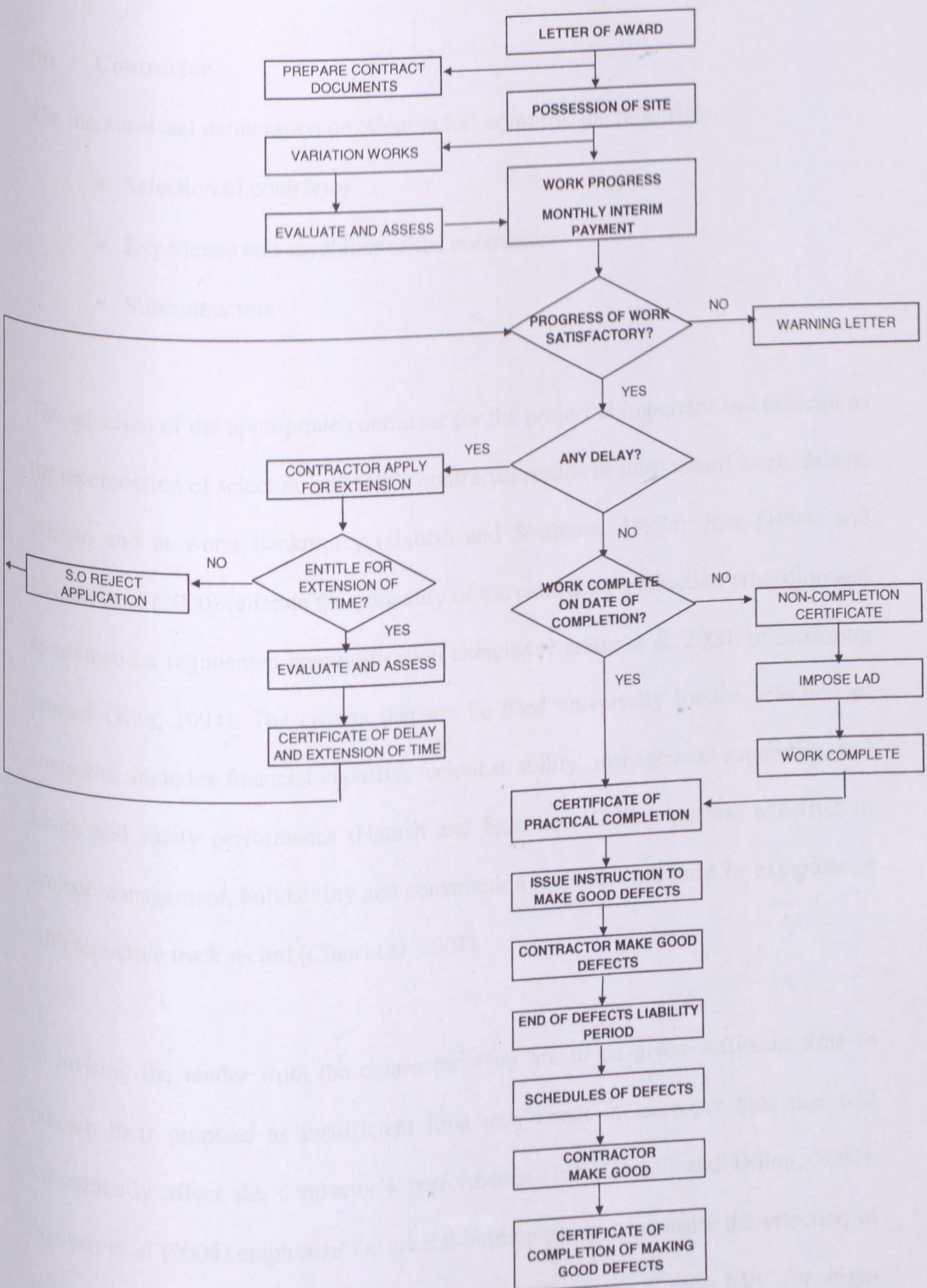


Figure 2.46: Contract Administration

Source: Abdullah (2008)

(b) **Contractor**

The literature and deliberation on 'Contractor' comprise the following:

- Selection of contractor
- Experience and capability of the contractor
- Subcontractors

The selection of the appropriate contractor for the project is important and difficult as the repercussion of selecting unsuitable contractor results in substandard work, delays, dispute and at worst bankruptcy (Hatush and Skitmore, 1997a). Ritz (1994) and Kartam et al (2000) reiterate the criticality of the contractor's selection procedure and recommend a regimented prequalification exercise (Kartam et al, 2000) or screening process (Ritz, 1994). The criteria that are be used universally for the selection of contractor includes financial capacity, technical ability, management capability, and health and safety performance (Hatush and Skitmore, 1997a), possess expertise in project management, buildability and construction methods, and must be experienced with reputable track record (Chan et al, 2001).

In inviting the tender from the contractor, they are to be given sufficient time to prepare their proposal as insufficient time may result in improper bids that will subsequently affect the contractor's performance (Pate-Cornell and Dillon, 2001). Nguyen et al (2004) emphasize the crucial bidding process to ensure the selection of the right contractor to successfully implement the project especially for high-technology project.

PWD outlines its procedure for the evaluation of contractor during the tender stage (Malaysia, 1993) and develops computerized software for the screening processes. The evaluation process undergoes three screening stages. The first stage takes into consideration the sufficiency of the tender that includes submission of all the required documents and completion of the required forms, possesses the required minimum financial capacity, and satisfactory progress of current works in hand. Upon qualification of the first stage, the successful contractor will go through the second stage namely the technical and financial evaluation. The evaluation criteria for the financial capacity are based on the contractor's finances and sources of fund, and credit worthiness. The criteria for the technical capacity are based on experience, key technical personnel, and availability of plants and equipment. The third stage of the evaluation process is to acquire the best economical tender amongst the contractors who qualify the second stage of the evaluation. The evaluation takes into consideration other aspects of the tender namely excellent track record and proposed completion period.

It is common practice for contractors to engage specialist or general subcontractors for various elements of construction works (Construction Industry Contracts Committee, 2006). Bently and Rafferty (1992) claim that these subcontractors play an important role in the successful completion of projects. They advocate several steps to be taken by contractors to ensure good working environment for the subcontractors. These include prompt payment, provide support for any work change, efficiently plan and coordinate works among the various subcontractors, and clear scope of work. To assist contractors and subcontractors in their contractual agreement, a model terms for subcontract works has been developed that serves as a template for them to draft their own contractual agreement (Construction Industry Contracts Committee, 2006).

(c) Technical

The literature and deliberation on 'Technical' comprise the following:

- Coordination between consultants
- Resolution of technical issues
- Design and construction methods
- Authorities approval

Kwak (2002) defines technical factors as those that involve design, engineering, construction, and installation operation and compatibility of equipments. This also includes standards, specifications and construction methods. According to Cheung et al (2001), construction involves complex technical process and is not an exact science that culminates into one perfect solution.

Jha and Iyer (2005) recognize coordination among project participants as one of the important 'ingredient' for success of construction projects and this include coordination between consultants. According to them due to the involvement of multitude of designers, consultants and specialists in the construction industry, proper coordination has resulted in the success of many multi billion dollar projects and likewise, lack of coordination has resulted in numerous failures of large building projects. According to the Board of Architects (2006), it is the responsibility of the Architect to instruct and coordinate other consultants. In fact, they are the lead consultants and have been acknowledged as the design leader (Tan, 2004b).

As important is coordination, so is resolution of technical disputes. Gao et al (2002) postulate that design and technical issues need to be resolved immediately between the designers and construction representatives and there should be frequent scheduled meetings for the purpose. Cheung et al (2001) anticipate delays, upset relationship, reduce efficiency leading to claims and litigation proceedings, should technical disputes and problems are not resolved immediately. As prevention is better than cure, they advocate for technical problems to be detected, anticipated and resolved before construction.

Pinto and Slevin (1994) acknowledge the importance of adequate technology and availability of the required technology or technological resources. Kartam et al (2000) observe that as the construction industry matures, it is becoming more technologically complex. As such, there should be improved buildability of design and updated construction methods.

Inefficient and lengthy approval process may disrupt implementation of projects (Chua et al, 1999 and Kartam et al, 2000). Chua et al (1999) highlight the importance of the efficiency of technical approval authorities in ensuring the project completes within the contract period. These include statutory approval for development order and building plans, and other authorizations, permits and the likes. The processing of the applications for these approvals take time and vary in different projects, cities and states, and range from a few weeks to several months (Malaysia, 2007f). It is thus important that the applications are timely to ensure approvals are obtained whenever required.

(d) **Innovation**

The literature and deliberation on 'Innovation' comprise the following:

- Innovation and improvement
- Research and development

Innovation is to make something new and according to Tidd et al (1997) it is 'a process of turning opportunity into new ideas and putting these into widely used practice' and it is essentially about making changes. Pries and Janszen (1995) describe innovation as a new process or technology.

There are two kinds of innovation namely product innovation and process innovation (Tidd et al, 1997). They hypothesize that due to the constant changing of the environment, the survival of an organization is seen through its capability to adapt and being able to offer new product or process development. Kay (1993) draws attention to the experience of successful companies that shows one of the distinctive capabilities in turning around the company into a global success is through innovation. Similarly, Mohamad (2008) states that global success and global optimization is through innovation of technology.

Collis and Montgomery (1977) highlight the importance of having a competitive advantage to be relatively ahead of competitors. And the key to maintain a competitive advantage over others is through innovation (Bender et al, 2000), as the capacity to innovate influence its long-term competitiveness and effectiveness (Fairclough, 2002). However, according to Pries and Janszen (1995), this source of competitive edge would only be effective if it is properly managed. Through innovation the organization is able to offer better product or service namely faster, cheaper and of higher quality (Tidd et al, 1997). Pate-Cornell and Dillon (2001) undertake case study of four projects and observe that innovations or improvements seems to have made a difference in the production and management of a 'faster-better-cheaper' projects.

Pries and Janszen (1995) conduct a study within the construction industry and observe that approximately 72.4% of innovation derives from the suppliers, 7.5% from the contractor and the balance are from the consultants and others. They conclude that the dominant innovator in the construction is from the supply industry.

However, compared to other industries, construction industry is tradition-bound and conservative and is relatively slow in developing and applying new technologies and innovative construction method (Pries and Janszen, 1995). Rosenfeld (1994) states that this barrier is due to the characteristics of the construction industry where the industry is capital intensive, with legal responsibilities and very fragmented.

It is capital intensive involving large fixed investment and as such stakeholders are more inclined to use the mainstream, time-tested design, materials and methods of construction even if there are new innovative products or processes that promise to have the potential of being more efficient. The construction industry is also litigious with an increasing number of disputes between contracting parties resulting in the stakeholders especially the contractors and consultants being more cautious in practicing new methods and technologies.

In addition, the construction industry being fragmented means that successful innovations by the contractors or consultants benefit the owner but whenever that innovations fail, the contractors or consultants is faulted. As such Rosenfeld (1994) claims 'this imbalance between risk and profit discourages inventiveness'. However, Nathan (2008) insists that for the construction of complex building, innovation in technology is not an option but a necessity.

Tatum (1987) states that to implement a new innovative construction technology requires organizational commitment, resources, experimentation, iteration and refinement. And the decision to proceed with the innovation is based on project requirements, expected benefits, risk and liability, and flexibility of the technology. Fairclough (2002) terms this as the research and development (R&D) which is the key driver of innovation. Acknowledging that R&D requires large amount of commitment on resources, Fairclough (2002) insists that the government must be involved in R&D for the construction industry not only as regulator, but also as sponsor and client.

The Construction Industry Master Plan (Malaysia, 2007b) provide several strategic thrusts to ensure a vibrant and dynamic construction industry generating foreign income and fulfilling domestic needs. One of these strategic thrusts involves innovation through R&D. The Construction Industry Master Plan highlights nine research priority areas where the government will play a major role in such R&D undertakings. These research priority areas shown in Table 2.27 are construction materials, machinery and equipment, industrialization of construction, IT, environment sustainability, health and safety, architecture and habitat, and other engineering aspects of construction.

One of the innovative undertakings carried out by the Construction Industry Development Board Malaysia is the Industrialized Building System (IBS). IBS is a construction process that uses techniques, products, components or building systems which involve prefabricated components and on site installation. The adoption of IBS is to overcome the current labor-intensive method increasing efficiency and productivity (Malaysia, 2003).

Table 2.27: Research priority areas

RESEARCH AREA	DETAILS
Construction materials	Development of indigenous e.g. Timber, wood-based, bio-composites; Steel product based on local materials; Cement and concrete products; Rubber based products; Advanced material and technologies; Value added local materials; and Material performance and analysis.
Construction machinery and equipment	Construction machinery; and Test and measurement apparatus.
Construction productivity and quality	Construction management; Construction policy research; Buildability; Zero defects; Standards and quality development.
Industrialization of construction	Prefabrication and offsite production; Modular coordination; Standardization; Mechanization; Construction system and performance; and Process improvements.
IT in construction/ knowledge-based construction	Development towards integrated environment; Real-time data management; Computer aided design e.g. design software; Man-machine interfacing; Artificial intelligence and expert systems; Virtual reality; and Global information system.
Environment and sustainability	Environmental engineering; Sustainable construction; Life cycle analysis; Recyclables, reusability of building and construction materials; Energy efficiency; and Manipulation and properties through genetic engineering.
Construction health and safety	Research towards enhancement on health and safety at site; Occupational ergonomics; and Public health.
Architecture and habitat	Research towards living comfort; Human friendliness; Urban environment; Heritage and conservation; and Development of open systems.
Engineering aspects of construction	Research in technological aspects of construction in the areas of Building; Roads, railway, harbor, canals; Drainage and irrigation; Electrical & mechanical; oil & gas, telecommunication; and Bridges, dam, tunnel earthwork, waterworks and reclamation.

Source: Malaysia (2007b)

2.8 RANKING OF SUCCESS CRITERIA AND SUCCESS FACTORS BY OTHERS

There have been several studies conducted whether directly on indirectly regarding the ranking of components of project success. However, as observed in the literature review, researchers used the term success criteria and success factors interchangeably and these have caused confusion. As such, for the purpose of this study, these elements are categorized based on the definition given in paragraphs 2.6 for success criteria and paragraph 2.7 for success factors.

2.8.1 Ranking of success criteria

Studies on the ranking of success criteria have been conducted in various industries. Wateridge (1995) concludes that there appear to be no consensus on the most important criteria in judging the success of information technology projects. But subsequent studies have ranked these success criteria although with some qualifications. Hartman et al (1998) conduct an empirical study in the entertainment industry and rank end-user satisfaction as the critical success criteria, followed by time, cost, and quality.

Findings from studies on success criteria in various industries generally differ between the various studies. The study by Yang et al (1997) ranks the success factors as follows: quality, time, and cost. White and Fortune (2002) conduct a similar study and the ranking of success criteria are: meet client's requirement, time, cost, and quality. Similarly, the result of the study by Collins and Baccarini (2004) is as follows: satisfies owner's needs, quality, cost, and time.

In the construction industry, several studies have been conducted to rank the success criteria. Asif (2004) conducts an interview survey with owners, consultants and contractors. The study indicates time as the most important project objective, followed by cost and quality. Wang and Huang (2005) conduct a similar interview survey but the respondents are supervising engineers. The result of the study indicates stakeholders as most important and followed by quality, time and cost. The result of the empirical study by Gao et al (2002) on project managers indicates the criteria of cost followed by time, client satisfaction and quality. Based on their study, Chua et al (1999) conclude that all the three criteria of time, cost and quality are of equal importance and none of the objectives can be sacrificed.

In summary, the ranking of the success criteria by various authors using the terms as postulated in this study are tabulated in Appendix 8. Based on these empirical studies, the success criterion that is ranked as most important to achieve project success is summarized in Table 2.28.

Table 2.28: Most important success criterion by various authors

Authors	Industry	Most important success criteria
Hartman et al (1998)	Entertainment industry	Stakeholders' appreciation
White and Fortune (2002)	Various industries	Stakeholders' appreciation
Collins and Baccarini (2004)	Various industries	Stakeholders' appreciation
Wang and Huang (2005)	Construction (China)	Stakeholders' appreciation
Asif (2004)	Construction (Saudi Arabia)	Time
Gao et al (2002)	Construction	Cost
Yang et al (1997)	Various industries	Quality
Wateridge (1995)	Information technology	No consensus
Chua et al (1999)	Construction (Singapore)	No consensus

Source: Various authors as stated

2.8.2 Ranking of success factors

The result of a study by Pinto and Prescott (1988) indicates that the critical success factors are clear project mission, client consultation and top management support. A survey by White D and Fortune (2002) suggests that the top five critical success factors irrespective of industries are clear goals or objectives, top management support, adequate funds or resources, realistic schedule and end-user commitment. Shenhar et al (2002) took the study further by differentiating the nature of projects based on the degree of technological uncertainty. Their analysis indicates that for low uncertainty project, the critical success factors are selection of contractor, budget monitoring, design, quality management and autonomy of project manager. For high uncertainty project, the ranking of the critical success factors are project definition, project milestones, design considerations, documentation, policy and customer participation. Belassi and Tukel (1996) conduct a similar study and the five ranked as critical are client consultation, top management support, availability of resources, preliminary estimates, and project manager's performance.

A survey by Hartman and Ashrafi (2002) on information technology projects indicates the five ranked as most important are: owner informed of project status and approval obtained at each stage, owner consulted at all stages, project communication channels established, clear project mission and top management support. Similarly, Kanter and Walsh (2004) conduct workshops to identify success factors and conclude that the five critical project success factors are project definition and control changes, realistic project schedules, project manager, project team, project monitoring and control.

For the construction industry, Belassi and Tukel (1996) postulate that the critical success factors ranked as important are top management support, project manager's performance, availability of resources, and client consultation. The study by Asif (2003) on construction projects in Saudi Arabia ranked the following critical success factors: clearly defined project mission, adequate planning, adequate controlling techniques, owner's acceptance and adequate plans and specifications. Nguyen et al (2004) summarize the five critical success factors as competent project manager, adequate funding, project team, commitment to project and availability of resources.

The finding of a research by Chan (2004) in Hong Kong healthcare projects shows that the critical success factors are project management actions, project team and leadership, client's representatives' capabilities, contractor and nature of the project. Iyer and Jha (2005) conduct a study on construction projects in India and conclude that the five ranked critical factors are project manager's competence and capability, top management support, monitoring and coordination, key stakeholders' commitment and client's competence.

In summary, the ranking of the success factors by these authors is tabulated in Appendix 9. Based on the studies by various authors, the critical success factors are further classified in accordance with the success factor groups as suggested in this study and are as shown in Table 2.29. The success factor ranked as critical by these studies falls under all the various success factor groups of human management, process, organization, and contract and technical.

Table 2.29: Critical success factors by various authors

Authors	Industry	Success factor group
Belassi and Tukel (1996)	Various industries	Human management
Shenhar et al (2002) – high technology project	Construction (Israel)	Human management
Hartman and Ashrafi (2002)	Entertainment	Human management
Kanter and Walsh (2004)	Information technology	Human management
Nguyen et al (2004)	Construction (Vietnam)	Human management
Iyer and Jha (2005)	Construction (India)	Human management
Pinto and Prescott (1988)	Various industries	Organization
White and Fortune (2002)	Various industries	Organization
Belassi and Tukel (1996)	Construction	Organization
Asif (2003)	Construction (Saudi Arabia)	Organization
Chan (2004)	Construction (Hong Kong)	Process
Shenhar et al (2002) – low technology projects	Construction (Israel)	Contract and Technical

Source: Various authors as stated

2.8.3 Ranking of success factors to achieve various success criteria

Belassi and Tukel (1996) analyze the ranking of success factors to achieve individual success criteria irrespective of industries as shown in Table 2.30. Their study reveals that the critical success factor to achieve either of the success criteria is similar, and that is 'availability of resources'.

Table 2.30: Ranking of success factors to achieve individual success criteria

Factors/ Measure	Time	Cost	Quality	Stakeholders' satisfaction
Availability of resources	1	1	1	1
Top management support	2	2	1	2
Project manager's performance	3	3	3	4
Preliminary estimates	4	4	4	5
Client consultation	5	5	5	3

Source: Belassi and Tukel (1996)

The study by Chua et al (1999) rank the success factors for different project objectives as shown in Table 2.31. Their study reveals that the most critical success factor to achieve the success criteria is similar and that is 'adequacy of plans and specifications'.

Table 2.31: Ranking of critical success factors for different project objectives

Success-related factors	Time	Cost	Quality
Adequacy of plans & specifications	1	1	1
Constructability	2	2	2
Project manager's commitment	3		4
Project manager's competency	4	5	
Contractual	5		
Economic risks		3	
Realistic objectives		4	5
Site Inspections			3

Source: Adapted from Chua et al (1999)

Asif (2004) ranks the success factors to achieve the various success criteria are as shown in Table 2.32. As in the previous studies, his study also suggests that the most critical success factor to achieve the success criteria of time, cost and quality is similar and that is 'clearly defined project mission'.

Table 2.32: Ranking of critical success factors for different project objectives

Factors/ Measure	Time	Cost	Quality
Clearly defined project mission	1	1	1
Adequate planning and control techniques	2	4	2
Owner acceptance or satisfaction	3	2	5
Adequacy of plans and specifications	4	5	3
Adherence to schedules	5		
Budget management		3	
Lack of legal encumbrances			4

Source: Asif (2004)

As a summary, the analysis and ranking of success criteria and success factors by previous researches and studies are as follows:

1. There seems to be no consensus on the most important success criterion as these studies have suggested either time, quality or stakeholders' appreciation.
2. There seems to be no consensus on the critical success factor to achieve project success as these studies suggested success factors under all the different factor groups of human management, process, organization, and contract and technical.
3. There seems to be no consensus on the critical factor to achieve each criteria of time, cost, quality and stakeholders' appreciation. However, these studies suggest that the critical factor is similar to achieve each of the success criteria.

Therefore, without knowing or identifying the critical factors it will lead to repetitive failure in project implementation.

2.9 SUMMARY OF LITERATURE REVIEW ON PROJECT SUCCESS

The literature on project success has reveal the confusion over the definition of project success. Scholars seem to agree that there is no consensus on what constitutes project success as there is no standard or common term for its definition. The debate on the definition of project success started since 1950's and has continued until now. From the early identification of time, cost and quality as a definition of project success, researchers have added many other outcomes and objectives including stakeholders, project manager, communication, leadership, project management, organization structure, resources, contract and more. Later refinements separate these elements into success criteria and success factors. However this is further aggravated as the terms used for success criteria and success factors are interchangeable or at times intertwine. This reveals a knowledge gap on a definitive description of project success.

The literature review establishes that scholars agree managing the many factors required to achieve project success are impractical and unachievable due to limited resources and time. Pareto principle of "important few trivial many" is advocated and this is done by identifying and choosing appropriate key success factors and expend all energy on them. However eventhough there are several studies being carried out there is no consensus on what comprises the key success factors. This reveals a knowledge gap on the identification of the critical success factors.

This study adopts the concept postulated by several researchers that project success comprises two components namely project success criteria and project success factors. Success criteria are the result area of what to be achieved and success factors are the organizational areas of how to achieve the success criteria. Four (4) success criteria and thirty-three (33) success factors have been identified as tabulated in Table 2.33.

Table 2.33: List of success criteria and success factors based on literature review

SUCCESS CRITERIA (What to achieve)	SUCCESS FACTORS (How to achieve)	
1. Completes within Time 2. Completes within Cost 3. Meets required Quality 4. Stakeholders' appreciation	1. Attitude, behavior and commitment 2. Client consultation and acceptance 3. Contracting 4. Contractor 5. Communication 6. Culture 7. Design 8. Documentation 9. Empowerment 10. Estimate 11. External environment 12. Financial resources 13. Goal/ objective and mission 14. Innovation 15. Learning organization 16. Monitoring and control 17. Organization structure	18. Performance, effectiveness and efficiency 19. Planning 20. Policy and strategy 21. Project manager 22. Project characteristic 23. Project definition 24. Quality management 25. Resources and personnel 26. Risk management 27. Safety program 28. Schedule 29. Stakeholder management 30. Team and leadership 31. Technical 32. Top management support 33. Troubleshooting

Various researchers postulate that these success factors should be grouped, as individually it will not affect the outcome of the project. As such, four (4) common and frequently mentioned elements in general management and project management literatures are being used to group these success factors. These are human management, process, organization, and contract and technical. The success factors are reduced to eighteen (18) significant success factors and classified under these groups by factor analysis as further described in Chapter 4. Further literature review is confined to these eighteen (18) significant success factors.

In summary, based on the literature review, the concept of project success is synthesized to be defined as achieving the success criteria (What to achieve) through the success factors (How to achieve). This is shown diagrammatically in Figure 2.47.

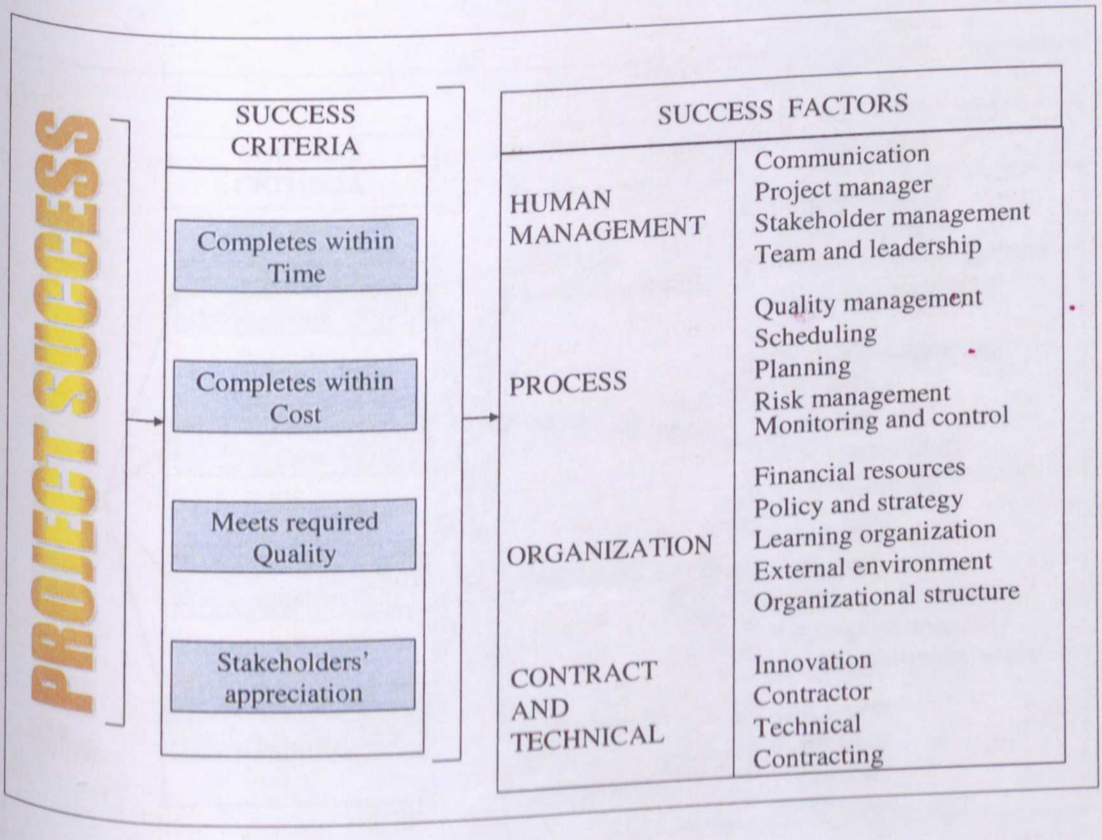


Figure 2.47: Project success

The relationship between project success, project success criteria and project success factors are further shown in Figure 2.48. Project success is achieved when the project meets any or all the four (4) project success criteria of time, cost, quality and stakeholders' appreciation based on what have been identified as the project objectives by the stakeholders. Each of the success criteria is achieved through the four factor groups of human management, process, organization, and contract and technical. Within each factor group comprises the various success factors. Human management comprises communication, project manager, stakeholder management, and team and leadership. Process comprises quality management, scheduling, planning, risk management, and monitoring and control. Organization comprises financial resources, policy and strategy, learning organization, external environment and organization structure. Contract and technical comprises innovation, contractor, technical and contracting.

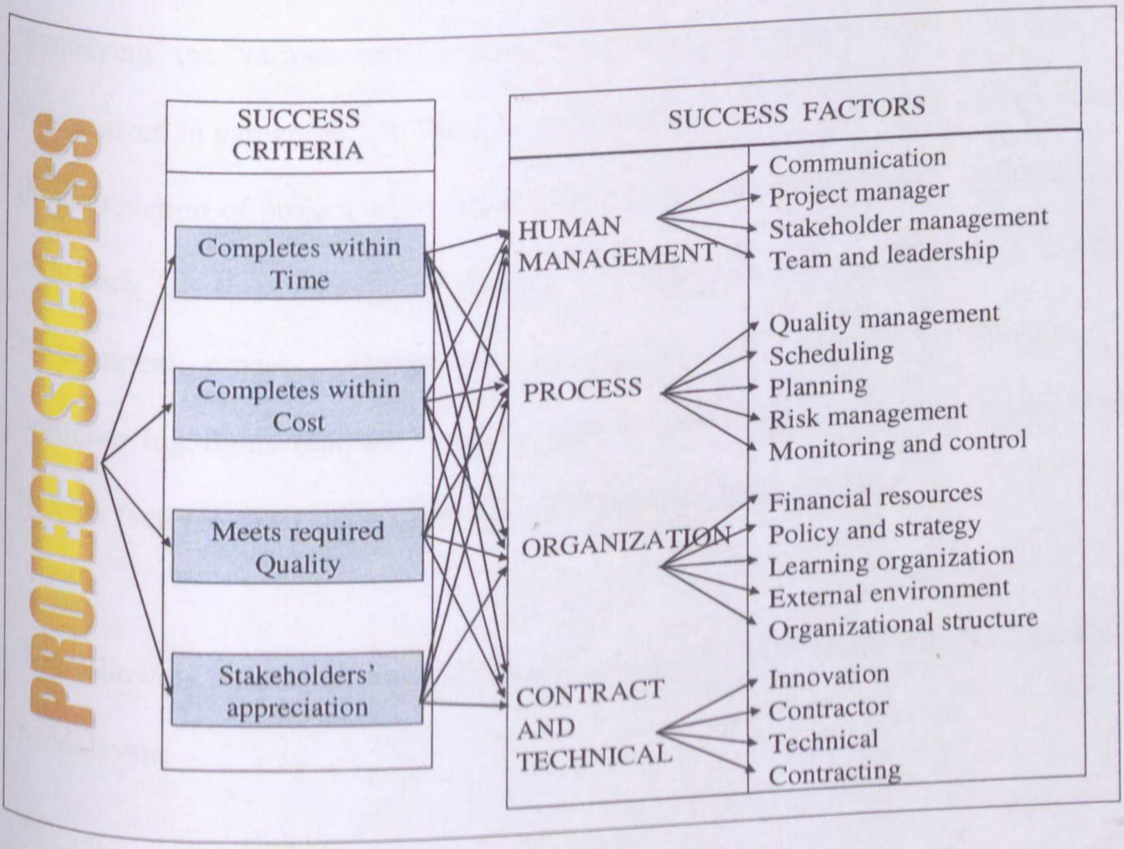


Figure 2.48: Relationship between project success, success criteria and success factors

From the literature studies as compiled in Figure 2.47 and Figure 2.48, there seems to be a knowledge gap as there is no precise evidence to prove which is the most critical factor to determine project success.

2.10 CONCLUDING REMARK

Chapter 2 presented the literature review with regard to the topic in general and project success in particular. On the onset it highlights issues pertinent to project implementation namely definition of project, project management, critical success factors, and project life cycle. It then further focuses on the definition of project success and describe in detail the two components of project success namely success criteria and success factors.

The literature study has assisted in building the concept of project success and identifying the various project success criteria and project success factors as summarized in paragraph 2.9. The literature establishes that project success comprises the completion of project within time, cost, quality, and stakehholders' appreciation, and each of these criteria is achieved through the factor groups of human management, process, organization, and contract and technical. In addition, the literature highlights that the common denominator of project success criteria and success factor in most studies inevitably include the human factor.

The following chapter examines generally the procurement and construction projects in Malaysia.

CHAPTER 3: PROCUREMENT OF CONSTRUCTION PROJECT IN MALAYSIA

3.0 INTRODUCTION

This chapter underlines the procurement of projects in Malaysia. Majority of the public sector projects or projects funded by the government are implemented through the Public Works Department Malaysia (PWD), Department of Irrigation and Drainage Malaysia (DID) and Ministry of Finance. These departments are the government's technical arms and implementing agency for construction projects. Whilst the private sector projects are managed by either, design consultants or project managers depending on the size of the project and the procurement strategy. It further highlights the number and value of construction projects awarded and discusses the challenges and the performance facing the construction industry.

3.1 PUBLIC SECTOR PROJECTS

Public sector projects are implemented through PWD and DID unless otherwise authorized (Treasury Instruction No. 182, 2005). Other government agencies may be authorized to implement projects as approved by the Ministry of Finance (Malaysia, 1982). PWD is responsible for the planning, designing and construction of development and infrastructure projects throughout the country (Public Works Department Malaysia, 2008). DID is responsible for the planning, design, implementation and management of all irrigation, drainage, river engineering, coastal engineering, and hydrology and water resources programmes and projects (Department of Drainage and Irrigation Malaysia, 2008).

The tendering procedure is generally through the open tender system unless approved otherwise by the Ministry of Finance Malaysia (Treasury Instruction No. 171, 2005). The other tendering systems comprising the selected tender and negotiated tender, requiring the Ministry of Finance Malaysia approval, are exception to the norm (Malaysia, 1995). The most common procurement method for government funded project is through the general traditional contracts. Other procurement methods namely turnkey contract or design and build contract and privatization are for special projects or under special programmes (Public Works Department Malaysia, 2008).

However, in 1997, Malaysia was caught in a severe regional currency crisis. The performance of the Malaysian economy in 1998, as with other East Asian economies, had been adversely affected by the deflationary impact of the financial crisis that plagued the region since mid-1997 (Malaysia, 1998a). In the effort to stabilize and to revive the country's economy, the government announced the National Economic Recovery Plan (NERP) that presents six strategic areas for action to address the crisis and its pervasive negative effects on the Malaysian economy (Malaysia, 1998b). The recovery plan provides the framework for action to bring stability to the ringgit, restore confidence, strengthen the fundamentals of the economy, continue the equity and socio-economic agenda, as well as revitalize the financial and real sectors.

Amongst the measures proposed in the NERP is with regard to the procurement of government funded projects. The government is to continue to invest in civil works and infrastructure development, especially for social projects. This is to provide some measure of support to the construction sector as well as its multiplier economic effects, reduce the severity of unemployment and business losses, and increase the utilization of surplus equipment and materials (Malaysia, 1998b).

With such recommendation for the construction industry, the government proceeded to allocate a stimulus package of RM7 billion in 1998 (Malaysia, 1998a) and later another stimulus package of RM3 billion in 2001 (Malaysia, 2001a) for the development of public sector facilities. The government began to step up efforts to eliminate bureaucratic delays as a measure to accelerate project implementation and completion in order to sustain economic growth as well as improve delivery of public goods and services.

In 1999, to support the huge allocation for the construction sector and to ensure that public projects would be implemented immediately, the government machinery issued instruction on the delivery process (Malaysia, 1999). Through this circular, the government accorded special exceptions from the normal procurement method and tendering procedure for projects not exceeding RM20 million for federal projects and RM5 million for federal projects implemented in the state, to ensure speedy procurement of works.

The special exceptions accorded for 1999 for works procured in 1999 and effective until December 1999 were for the following issues:

i. Implementing agencies – All government agencies were given the authority to implement their own projects and not through PWD.
ii. Procurement method - government agencies were given the authority to choose the procurement method of either traditional or design and build contract.
iii. Tendering procedure – government agencies were given the approval to issue tender based on negotiated or selected tender.

iv. Appointment of consultant Architects, Engineers and Quantity Surveyors – government agencies were given the authority to appoint such consultants to assist them in the implementation of their projects.

In 2000, in order to further accelerate project implementation as well as reduce processes, the government appointed project management consultants (PMC) to supervise public sector projects. Projects were awarded on design-and-build basis to shorten processing time as well as expedite project completion. These special exceptions from the normal procurement strategy was instructed to all the government agencies for federal projects not exceeding RM20 million and for federal projects implemented in the state not exceeding RM5 million (Malaysia, 2000). This amount was subsequently increased to RM30 million for federal projects (Malaysia, 2001b). The special exceptions commenced from September 2000 until August 2001. An extension was given until December 2002 (Malaysia, 2001c). These special exceptions were similar to the previous instructions in the year 1999 with slight modifications as follows:

i. Implementing agencies – All government agencies with no technical departments, were required to appoint PMC in accordance with the location for the project management services.
ii. Procurement method – To ensure speedy implementation of projects, the procurement would be through design and build or turnkey contract.
iii. Tendering procedure – The tendering method of selected tender required no approval from the Ministry of Finance Malaysia. However, for negotiated tender, the government agencies were required to seek such approval.

With the above changes in the procurement strategy for government-funded projects, there was an advent surge of PMC, made more distinct and apparent from the year 2000 to 2004. Due to the direct implementation of public projects by other government agencies, a large number of PMC were set up to take advantage of these special exceptions from the normal government procurement strategy.

However the sudden surge of private consultants i.e. the PMC, implementing public projects highlighted the expertise or lack of expertise of PMC. Project success and failures are suddenly in the limelight due to projects being implemented at such a tremendous pace from 1998 to 2004. The scrutiny on the implementation of public projects was made more evident since their implementation was not only undertaken by government implementing agencies but private sector consultants. In 2004, the government instructed that the procurement of government-funded works would be implemented by the government implementing agencies (Malaysia, 2004). This instruction cancelled all the special exemptions accorded to other government agencies in the implementation of works projects.

3.2 PRIVATE SECTOR PROJECTS

Harbans Singh (2002) states that the tendering system for majority of the projects are carried out through well defined and industry recognized procedures and the commonly employed procedures are open tender, selective tender, negotiation and joint-ventures. Of the types listed, the most familiar are open tender, selective tender and negotiated tender.

He further notes that the procurement method that have established themselves as industry sanctioned norms are the traditional general contract, design and build contract, management contracting type and miscellaneous types of contracts namely fast tracking and partnering. The procurement method familiar to local practitioners due to their continued use in the past is the traditional general contracts. The design and build and management contracting are currently being implemented but not to its full potential. These various procurement methods are being utilized in one form or another in engineering and construction contracts but there has been no data on the extent of their usage.

3.3 PROJECTS AWARDED

The total number and value of construction projects awarded from the year 2003 to 2007 are shown in Figure 3.1 and 3.2 respectively. During these years, an average of 5,490 numbers and an average value of RM61 billion per year of projects are awarded (adapted from Hassan, 2005 and Malaysia, 2008d).

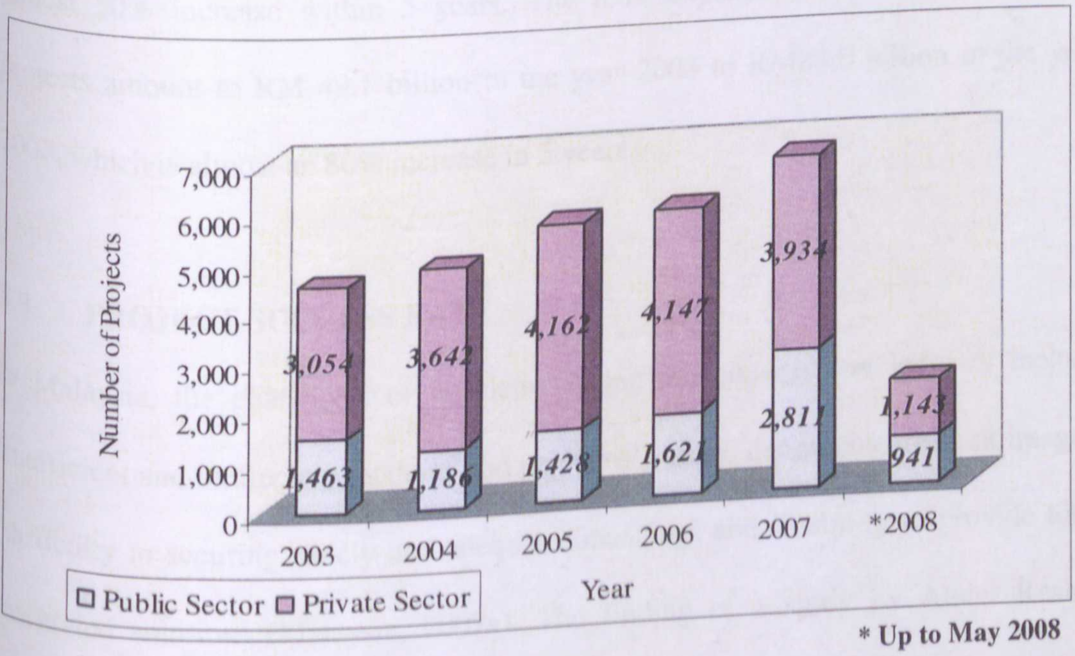


Figure 3.1: Number of projects awarded as of May 2008

Source: Adapted from Hassan (2005) and Malaysia (2008d)

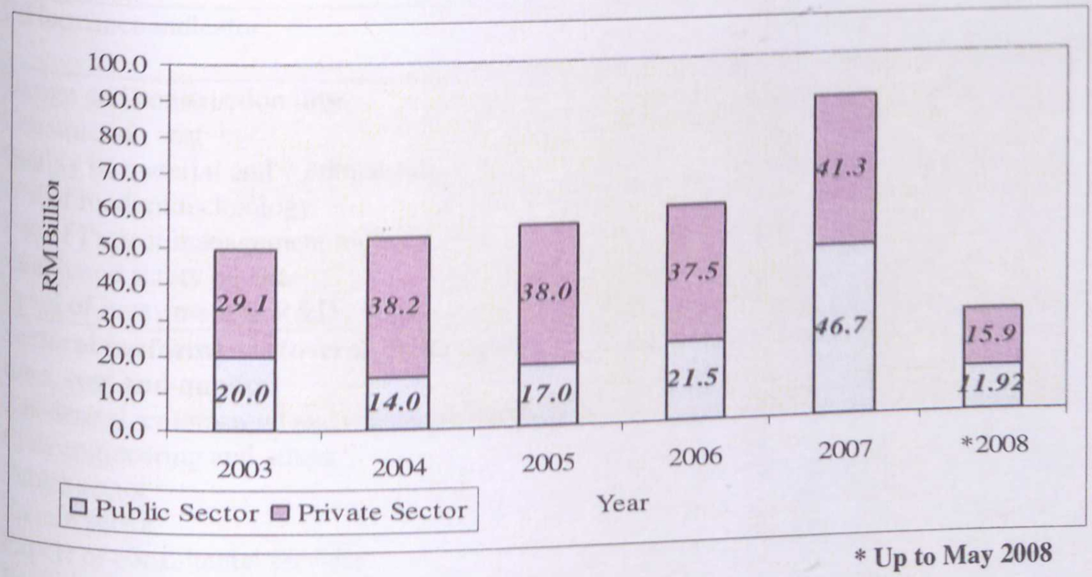


Figure 3.2: Total expenditure for projects as of May 2008

Source: Adapted from Hassan (2005) and Malaysia (2008d)

As shown in Figure 3.1 and Figure 3.2, there is a tremendous increase in the number of construction projects though the years. The total number of projects awarded has increased from 4,517 numbers in the year 2003 to 6,745 in the year 2007 that is almost 50% increase within 5 years. The total expenditure for the construction projects amount to RM 49.1 billion in the year 2003 to RM88.0 billion in the year 2007, which is almost an 80% increase in 5 years.

3.4 PROJECT SUCCESS RATE

In Malaysia, the challenges or problems facing the construction industry include 'inefficient and ineffective methods and practices', 'dirty, dangerous, difficult image', 'difficulty in securing timely and adequate financing' and 'inability to provide total integrated solution' (Malaysia, 2007a). The finding of a study by Abdul Rashid (2002) shows that the performance of the construction industry is below average as shown in Table 3.1.

Table 3.1: Performance of Malaysian construction industry

Performance indicator	Performance			
	Poor	Good	Very Good	Excellent
Design and construction time		o		
Construction cost		o		
Quality of material and workmanship		o		
Use of modern technology		o		
Use of Project management tools		o		
Health and safety on site	o			
Level of investment in R&D		o		
Sectoral performance (overall in terms of time, cost and quality				
Residential, commercial and industrial buildings		o		
Civil engineering and others		o		
Public sector		o		
Private sector		o		
Export of consultants' services	o			
Export of contractors' services		o		
Success of technology transfer	o			

Source: Adapted from Abdul Rashid (2002)

Table 3.1 shows the performance of the construction industry rated in terms of the various indicators namely design time, construction time, construction cost, quality, technology, project management tools, and standard of workmanship. There is no performance indicator that has been rated as either very good or excellent. The performance for health and safety, foreign consultants' services, and technology transfer is rated as poor while other indicators are rated as merely good.

Delays in construction projects are prevalent (Abdul-Rahman et al, 2006). In a study by Othman (2006) reports that 42% of the projects completed on or before date of completion and the remaining 58% completed either on extended period or delayed or not completed. Another study on government funded projects reported that only 112 out of 512 projects or 22% of the projects completed on the date of completion. The remaining 400 (78%) projects incurred delay with an average of approximately 171 days per project (Malaysia, 2007g).

Report based on government projects implemented (Malaysia, 2008e) states that in October 2008, a total of 1,428 projects have been awarded under 9th Malaysia Plan (2006 – 2010) to the amount of RM27.34 billion contract sum. Out of these contracts, a total of 1,317 projects (92%) are progressing in accordance with the work program but the remaining 111 projects (8%) have been categorized as 'sick project' out of which 61 projects have overrun their date of completion. A project is considered as 'sick project' when the progress is delayed for more than 3 months. The New Sunday Times (2008) also reported that 45 sick projects under the Ministry of Works are undergoing rehabilitation with 15 more projects to be undertaken within the next two years.

In addition, the report (Malaysia, 2008e) based on key performance index, states that a total of 384 projects are to be handed over to the client in October 2008. Out of these projects, 333 projects are on schedule to be handed to the client and there is a delay of 13.28% where 51 projects will not be able to be handed to the client as scheduled.

It has been identified that majority of variation works occurs due to design mistakes, request for changes by the client, site difficulty, construction problems on site, changes in procedures, and relocation of existing utilities (Malaysia, 2006b). It was reported (Malaysia, 2007g) that under the 9th Malaysia Plan, out of RM8 billion worth of contract, the cost had increase by RM290,000 million which is approximately an increase of 3.6%. The report also highlights the statistics from the Implementation and Coordination Agency, Malaysia on a study based on 156 projects costing RM4.3 billion, incurring an additional works of over 20% of the cost. It was also reported that another study based on 20 project samples indicates 48% of the variation works are due to request by client, 22% due to incomplete design, 18% due to human error, 9% are unanticipated works and 5% due to local authority requirements.

According to the Auditor General's report (Malaysia, 2007h), the main flaws in quality that have been identified are serious structure defects, settlement, soil erosion, leakage, unsuitable building layout, poor quality materials, poor workmanship, defects in equipment and malfunction facilities.

3.5 CONCLUDING REMARK

Chapter 3 presented the procurement of construction projects in Malaysia. For the private sector, projects are procured by clients through industry recognized and commonly employed procedures that are familiar to the stakeholders. However, for the public sector, projects are implemented through PWD, DID and Ministry of Finance. The procurement is strictly regimented through procedures and instructions from the Ministry of Finance Malaysia. It also highlights the environment of the construction industry in Malaysia that is seen as inefficient with below average performance. Reports on the implementation of the government funded projects indicate delays in the achievement of time, variation on cost and flaws in quality.

The following chapter describes the methodology used for this thesis.

CHAPTER 4: RESEARCH METHODOLOGY

4.0 INTRODUCTION

This chapter describes the methodology used in this research. This is an important part of the research as it will eventually determine the reliability of the analysis and the findings. This chapter starts with a discussion on the methods by previous studies as a reference to the various techniques used. It then goes on to describe the approach of the study.

Based on the literature review, a theoretical model is then developed. The proposed theoretical model can be use by practitioners and stakeholders in the selection of the criteria and critical factors for project success. For data collection, this research carried out a preliminary study and field survey using structured questionnaires. Data is then analyzed based on the multivariate statistical analysis.

This study emphasizes on respondents' knowledge and perception based on their vast experience in implementing and delivering successful projects in the Malaysian construction industry. It is postulated that a set of significant success criteria and critical success factors will emerge from the study and as such, the lessons learnt by the respondents on what are the inter-related key areas that are critically important are captured in this study. This study then, correlates the project success factors to project success criteria relevant to the Malaysian construction industry.

4.1 PREVIOUS RESEARCH METHODS ON PROJECT SUCCESS

Chapter 2 identifies several project success models developed in previous studies by various authors. Chua et al (1999) observe that studies conducted to identify critical success factors have been using both the quantitative measures and expert opinion. However, based on the review of current literatures, while a few studies used qualitative, the common methods chosen is quantitative. Several researches conducted preliminary or pilot study using structured questionnaires prior to the field survey. Based on that experience, the structured questionnaires were then refined before embarking on the field study.

The methods and analysis used by the researchers are tabulated in Appendix 10. The multivariate statistical techniques are used to analyze data by these studies namely descriptive statistics, factor analysis, linear regression, stepwise regression, correlation analysis, frequency of mention, quantitative ranking, and relative importance index. For most of the studies, the respondents are a mix of clients, contractors, consultants, supervising engineers, project managers in both private and public sectors and statutory bodies. The studies are carried out in various industries namely the information technology industry, entertainment industry, telecommunication industry, mining industry, transport industry, and construction industry. However, the analysis is generalized even though the respondents are from different categories of stakeholders and industries.

Based on the various methods adopted by previous researchers, this study opts for the quantitative methodology using structured questionnaire survey including a preliminary study prior to the field survey.

4.2 APPROACH OF STUDY

The three main approaches or styles of research are the ethnography approach, the survey approach and the experimental approach and based on the data collected the results from these researches are shown either as descriptive or inferential (MAMPU, 1987, Gill and Johnson, 1991, Ahmad Mahdzan, 1992, Jesson, 2001, and Arifin, 2004). The survey approach is able to describe, explain and explore a phenomenon (Gill and Johnson, 1991), able to arrive at a reasoned conclusion by logically generalizing from a known fact (Sekaran, 2000, and Tricker, 2001) and is efficient and accurate to gain information on a population (Zigmund, 2000). Since that is the basic requirement of this study, the survey approach is chosen.

Further, Kerlinger (1986) classifies the survey approach according to the methods of obtaining information that is by personal interview, mail questionnaire, panel, telephone and controlled observation. Although he considers the personal interview as the most powerful tool for social scientific survey research, this study elects to use the structured questionnaire survey method. This approach is advocated where there is already a strong body of accepted theory, models or concepts (Aripin, 2004). There are numerous studies on the subject of project success and taking into account all the attributes highlighted by the previous studies this study is able to construct a comprehensive theoretical framework.

This study involved the combination of result area and organizational areas of construction projects. As such, it is not only concerning technical issues but also management areas. In this aspect, Gill and Johnson (1991) state that when the study involve management contexts, in principle the research should be done through testing a hypothesis by data analysis or describing the behavior of a specific population. However, Supranto (1986) advocates data analysis on the behavior of individual and role of organization to correlate management problems.

According to Lester (1980) and MAMPU (1987) prior to the commencement of any research, the researcher needs to determine the type of research and how it will be carried out. This is important to enable the researcher to decide on the research process, theoretical framework and data collection.

4.3 RESEARCH PROCESS

Sekaran (2000) creates a model for a research process as shown in Figure 4.1.

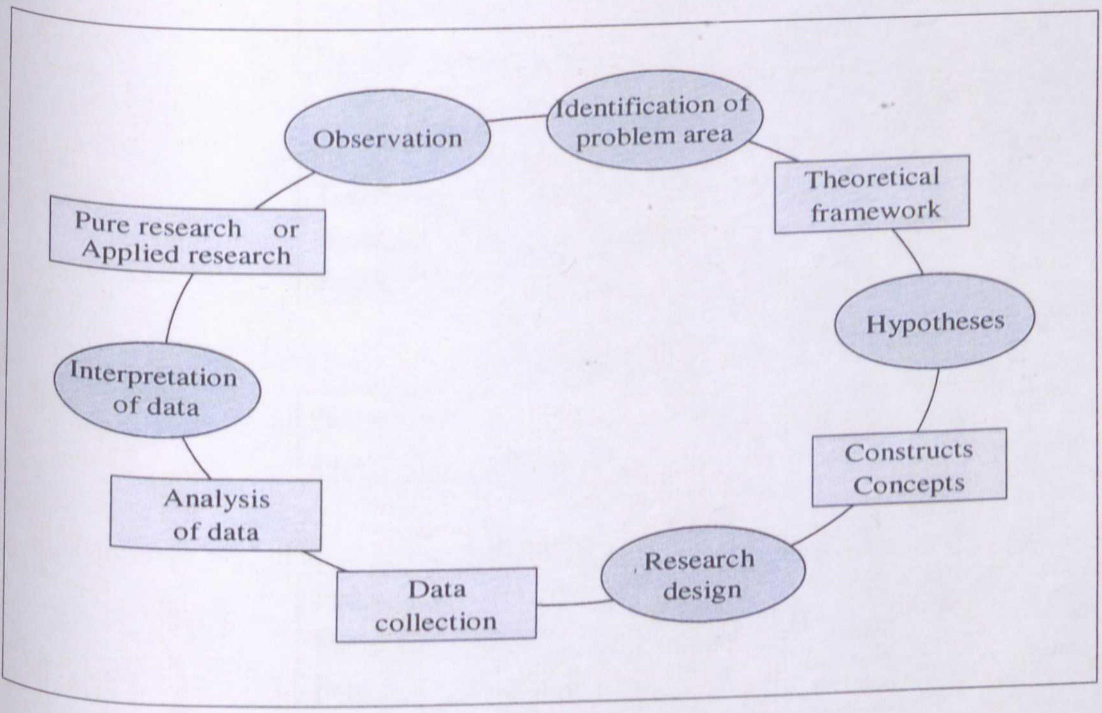


Figure 4.1: The research process for basic and applied research

Source: Adapted from Sekaran (2000)

This study adopts the research process advocated by Sekaran (2000) and starts with defining a problem by identifying broad areas of interest through observation and preliminary gathering of data synthesized with experience within the construction industry. Then a theoretical framework is developed that identifies all the attributes of project success. Based on this, the research framework is then designed and data collected, analyzed, interpreted and reported.

The research framework for this research study, adapted from Chan et al (2004), is in two phases as shown in Figure 4.2. The first phase is the data collection comprising literature review, preliminary study and field study. The next phase of the study is the data analysis and findings.

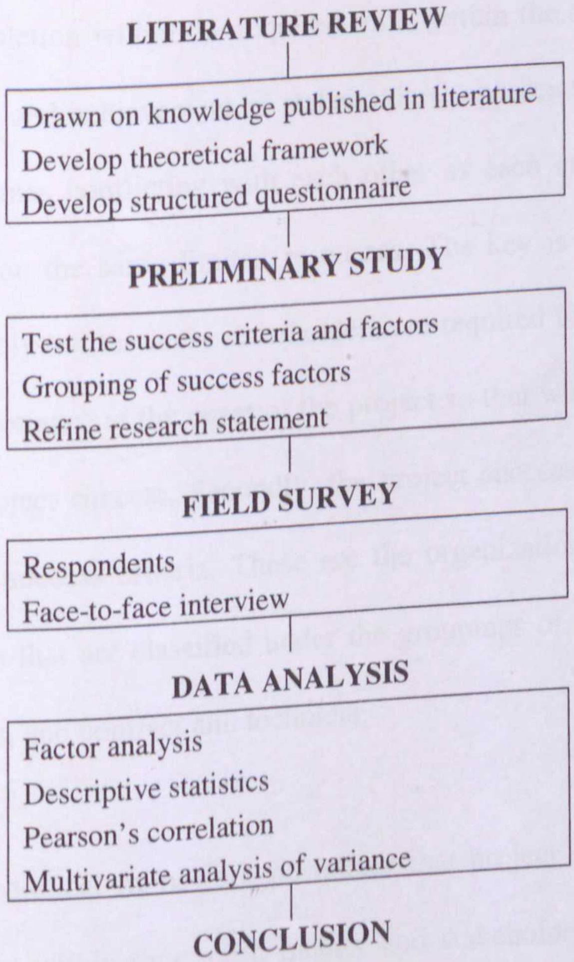


Figure 4.2: Research framework for this research study

Source: Adapted from Chan et al (2004)

4.4 THEORETICAL FRAMEWORK

The main objective of developing a theoretical framework is as a basis and guide for the research (Sekaran, 1984). The theoretical framework for this study is shown in Figure 4.3. It is formulated by synthesizing all the attributes of project success as postulated by various researchers and the literature reviewed in Chapter 2.0. The framework, which is a refinement of the diagram in Figure 2.48, articulates that project success comprises two components.

Firstly, the project success criteria that explain what are to be achieved. These are the result areas on completion within the required time, within the allocated cost, meets the required quality, and achievement of stakeholders' appreciation. The criteria are competing and at times conflicting with each other as each criterion is pulling at different directions on the same limited resources. The key is not only to balance these criteria delicately but the main stakeholders are required to prioritize and agree on their relative importance at the onset of the project so that when trade-offs happen it will not affect project success. Secondly, the project success factors that explain how to achieve the success criteria. These are the organizational areas comprising eighteen (18) factors that are classified under the groupings of human management, process, organization, and contract and technical.

In summary, the theoretical framework postulates that project success comprise the completion of project within time, cost, quality and stakeholders' appreciation, and each of these criterion is achieved through the factor groups of human management, process, organization, and contract and technical.

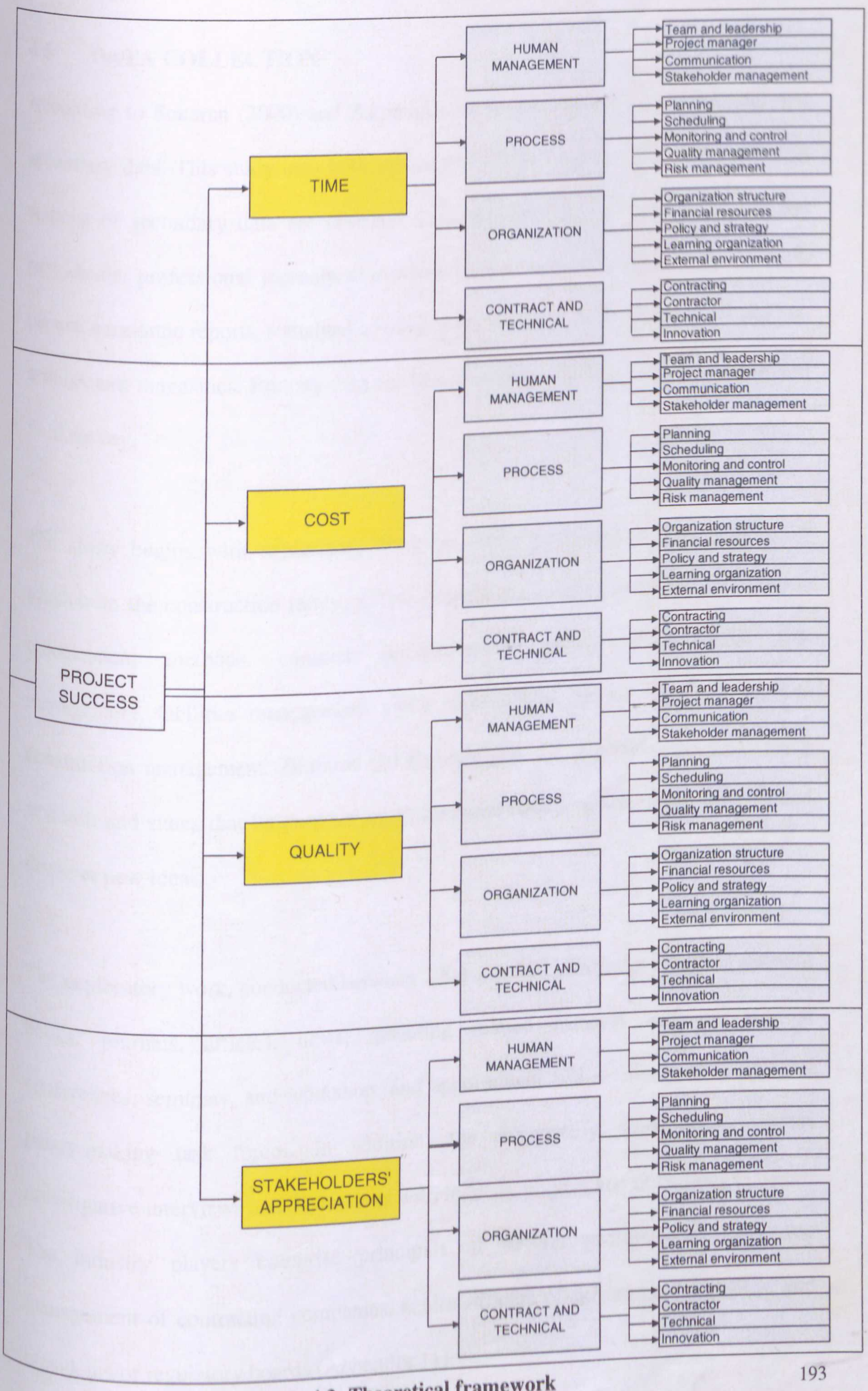


Figure 4.3: Theoretical framework

4.5 DATA COLLECTION

According to Sekaran (2000) and Zikmund (2000) data sources can be primary and secondary data. This study uses both secondary data and primary data. The principal sources of secondary data are obtained from documentary sources namely books, periodicals, professional journals, conference papers, refereed publications, research papers, economic reports, statistical sources, government sources, internet information articles and magazines. Primary data are obtained through the preliminary study and field survey.

The study begins with exploratory work on issues pertaining implementation of projects in the construction industry. This include the areas of tendering procedures, procurement methods, contract administration, quality management, risk management, facilities management, value management, project management, and construction management. Zikmund (2000) highlights the importance of exploratory research and states that its purpose are to diagnose situation, screen alternatives and discover new ideas.

The exploratory work, conducted between 2004 and 2005, includes studying relevant books, journals, articles, news, attending related national and international conferences, seminars, and workshop, and appointment and involvement in national policy-making task forces. In addition, the exploratory work also includes investigative interviews and discussions with industry players and university lecturers. The industry players comprise principals of several professional firms, top management of contracting companies, senior officers of government agencies, and presidents of regulatory boards (Appendix 11).

The two-prong approach of both the literature and investigative discussions proves to be effective. The relevant books, articles and news, and various conferences and seminars attended have assisted in streamlining and formulating several issues that are apparent and impending within the construction industry. The investigative discussions with university lecturers, consultants, contractors, government agencies and regulatory bodies, and clients enable a more focus, current, and pertinent issue to be the subject of the study. These assisted in identifying a clear and precise statement of the recognized problem (Zikmund, 2000).

4.5.1 Documentary sources

Secondary data can be freely available and is useful for familiarization process and generating ideas (Jesson, 2001) as it provide a body of knowledge to build on (Zikmund 2000). In addition, Denzin and Lincoln (2000) state that these documents are valuable as sources of reference and triangulation. Triangulation is used for the application of two or more methods on the same research problem to increase the reliability of the results (Gummerson, 2000).

A thorough literature review is carried out to identify the problem areas, to formulate the objectives and to choose the methodology of the study. According to Chan et al (2004), the literature review is to gather information, data and issues that will contribute in developing a framework for the study and preparing the structured questionnaires. The information and data collected that are then generalized and analyzed serves as a window to achieve the objective of the study (Bailey, 1984 and Balian, 1983).

4.5.2 Structured questionnaire

A major reason for choosing the survey approach rather than relying on secondary data sources is that the questionnaires can be tailored to the precise research objectives (Tricker, 2001). The questionnaires in this study are close-ended and tailored to the construct of the theoretical framework. However, respondents are given the option should they choose not to use the given multiple choice answers. A comprehensive structured questionnaire with guided interview based on the literature review of the success criteria and success factors was developed.

The questionnaire deals with three main issues to elicit the significance and correlation of both the project success criteria and factors. Firstly, it is with regard to the respondents' demographic profile as required in Section A of the questionnaire. Secondly, it is about the measurement of importance and agreement on the project success criteria as required in Section B and Section C. Thirdly, it is the measurement of importance of success factors as required in Sections D, E and F. The last part of the questionnaire Section G is an optional section should the respondents wish to offer their comments and views. A sample of the questionnaire is attached in Appendix 12. The questionnaire comprises seven sections as follows:

1. Section A pertains to the respondents' demographic profile.
2. Section B collects data pertaining to the importance of project success criteria. This section addresses respondents' perception of what are the important criteria to be achieved in any successful implementation of projects. The respondents are required to rank these success criteria. It also includes the description of each of the project success criteria.
3. Section C pertains to agreement on project success criteria. This section still addresses the views of the respondents with regards to success criteria. But

instead of its importance, the questions aim at measuring the respondents' agreement on statements pertaining the success criteria.

4. Section D is on the importance of success factors for various criteria. This section addresses the respondents' perception of what are the levels of importance of the success factor groups in achieving each of the success criteria. The respondents are required to rank these success factor groups.
5. Section E is on the importance of success factors within the success factor groups. This section requires the respondents to rank each of the success factors within the four factor groups.
6. Section F is on the importance of elements of success factor. This section aims at measuring the respondents' perceptions on the description of each of the project success factors.
7. Section G records the comments and views of the respondents.

Although this study deals with measurement that is subjective and abstract, it could be translated into numeric data through the use of scale and analyzed through statistical analysis (Ahmad Mahdzan, 1992). As such, the scale of importance and the scale for ranking used is the five-point scale of 1 to 5 as follows: (1) Least important, (2) Quite important, (3) Important, (4) Very important, and (5) Critically important. In addition, the scale of agreement used the Likert scale of 1 to 5 where (1) Totally disagree, (2) Disagree, (3) Neutral, (4) Agree, and (5) Totally agree.

Peterson (2000) states that as the questionnaire is the 'heart and soul' of a research, it must be constructed effectively to ensure the respondents decode the research questions as intended by the researcher and the answers are encode to provide the relevant information. As such, in drafting the questionnaires, several points are considered to ensure reliability, accuracy and unbiased responses. The questionnaires are simple, brief and specific (Peterson, 2000), relevant, accurate, and not leading, loaded, ambiguous, or double-barrel questions (Zikmund, 2000), uplifting and not boring so as to motivate respondents to become involved (Ahmad, 2003) and involves 'selling' as to why it is important to participate in the survey to encourage cooperation (Tricker, 2001).

4.5.3 Preliminary study

Conducting a preliminary study prior to the actual field study is a best practice (Liaw and Goh, 2002, and Naoum, 1998). Preliminary study is beneficial as it sets and paves the way to achieve the objectives of the study (MAMPU, 1987). According to Ahmad Mahdzan (1992), preliminary study is carried out to test the relevance and clarity of the questionnaires, the suitability of the scales used, and the duration and cost of the interviews. These will then be the basis of the actual field study.

As such, this research conducts a preliminary study in 2006 for duration of three months. The objectives of the preliminary study are to test the success criteria and factors, for the purpose of grouping the success factors into generic factor groups, and the selection of significant success factors. The interviews are based on the structured questionnaires. The respondents are from a working group of thirty (30) professionals from the public and private sectors who have been chosen and appointed by the Construction Industry Development Board Malaysia to develop the curriculum for the national training module for 'Certified Construction Project Manager' (CCPM). Their qualifications range from architect, quantity surveyor, and engineer who have more than 15 years experience in the construction industry.

The questionnaires are given to all the members of the working group and twenty-five are completed. The interviews are carried out face-to-face with the respondents to assist in any queries faced by them. The focus of the preliminary study is for the respondents to rank the success criteria and success factors, and relevant questionnaires regarding the success factors using the scale of 1 to 5 as mentioned in paragraph 4.5.2.

Administratively, the outcome of the preliminary study shows that, notwithstanding some minor amendments, the questionnaires are clear and relevant to the objectives of the study. The utilization of the five-point scale is found to be equally suitable as the respondents are able to measure their perceptions using the scales. In addition, the structured questionnaires using face-to-face interview technique is very effective to clear any queries from the respondents. It is also noted that not more than two interviews could be carried out within a day. Although the actual time to answer the structured questionnaires is less than one hour, but respondents are equally eager to expand on the reasons for their responses.

To analyze the data, the success criteria are ranked based on the frequency of the responses received. The criterion that is frequently picked-out by the respondents is ranked as first. The next frequently picked-out criterion is ranked as second and this goes on until the last of the four criteria. Similarly, this simple technique of frequency of mention is carried out for ten (10) success factors. This technique is used by Belassi and Tukel (1996) and White and Fortune (2002).

The result of the preliminary study shows the success criteria ranked as first is '*Stakeholders' appreciation*', second is '*Quality*', third is '*Cost*' and lastly '*Time*'.

The top ten success factors chosen are '*Team and leadership, Project manager, Communication, Stakeholder management, Planning, Scheduling, Organization, Monitoring and control, Financial resources and Quality management*'. In addition, the findings of the preliminary study grouped the success factors into the factor groups of '*Human management, Process, Organization, and Contract and technical*'. The grouping is by applying the factor analysis technique to all the identified success factors (further explained in paragraph 4.6.1).

Using the classifications of the success factor groups, the result of the preliminary study that chooses 10 critical success factors falls under the groupings of '*Human management*', '*Process*' and '*Organization*' as shown in Figure 4.4. The emphasis of human management being the highly ranked success factor is also taken into consideration in synthesizing the research statement as stated in Chapter 1.

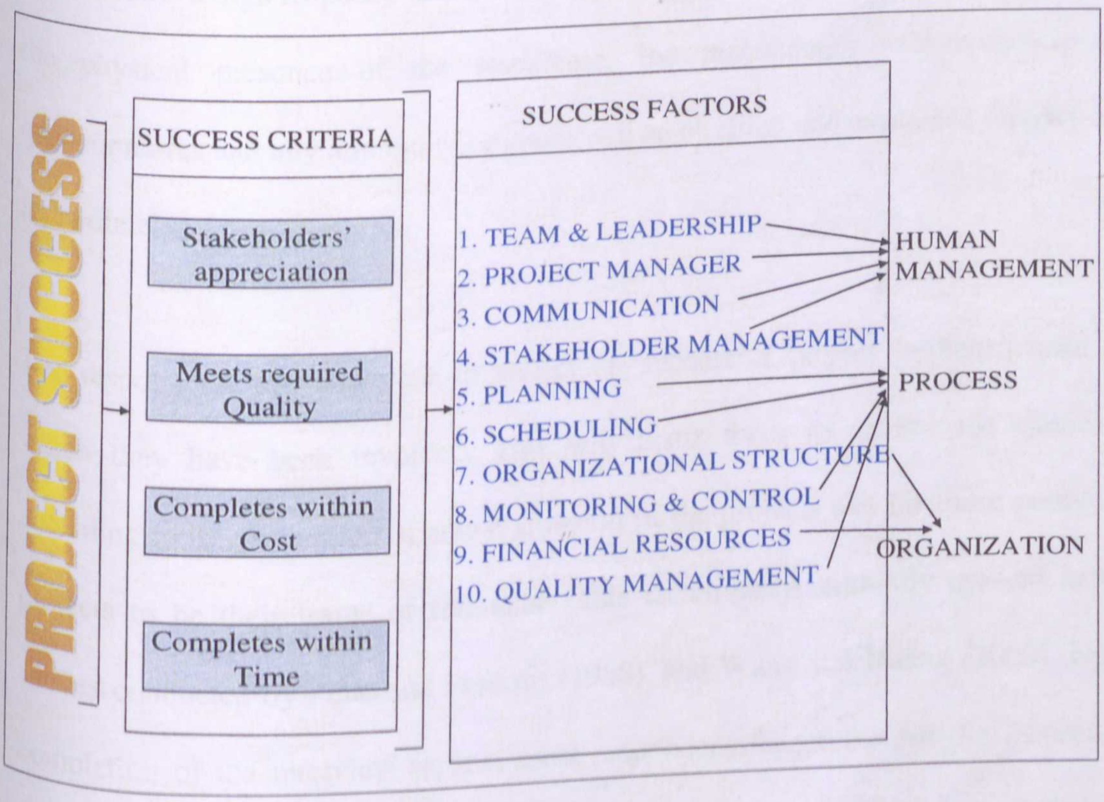


Figure 4.4: Categorization of success factors in the preliminary study

The findings of the preliminary study are presented in various seminars and congresses in Malaysia and in international conferences in Indonesia, Singapore, and Canada. The objectives are to test the idea and the concept of project success as postulated in the study, and the ranking of success criteria and the critical success factors. The concept and the ranking of both the criteria and factors in the seminars and conferences are favorably received by the participants.

4.5.4 Field survey

The field study is conducted through personally assisted questionnaire or face-to-face to ensure that the respondents understand the approach and objectives of the study, the components of project success and the definition of each criterion and factor. Naoum (1998) and Ahmad (2003) claim that this is the best method of data collection as it not only ensures a high response rate but also accuracy of results. According to them with the physical presence of the researcher, the respondents will complete the questionnaires and any ambiguity or doubt will be clarified and explained directly and immediately.

The respondents are requested to reflect on successful project implementation in which they have been involved. This will assist them to answer the questions according to the perception of actual situation of the projects and for those particular projects to be their frame of reference. This technique is similarly applied in the studies conducted by Pinto and Prescott (1988), and Wang and Huang (2005). Upon completion of the interview survey, most respondents requested for the theoretical framework for their reference. In addition, several respondents also requested to be informed of the final analysis.

4.5.5 Sample selection

The process of sampling involves a small number of the whole population to derive conclusions regarding that population (Supranto, 1986). This means that the respondents from the sampling will represent the population for the research (Naoum, 1998, and Sekaran, 2000).

There are two main techniques of sampling, that is probability sampling and nonprobability sampling (Sekaran, 2000; and Liaw and Goh, 2002). On the onset, this study chooses the probability sampling as according to Zikmund (2000) this technique ensures that every member of the population has an equal probability of being selected and as such, it is not bias which is inherent in nonprobability sampling.

The criteria set for the sampling of respondents are to ensure that they would be able to represent the population as required in the scope of the study. The criteria for the respondents are as follows:

a. The respondents must be involved in public sector projects namely government housing, clinics, offices, and infrastructure projects such as roads, highways, dams and bridges implemented through PWD, DID, relevant other government agencies and Ministry of Finance Malaysia;

b. The respondents held the position of project director (PD) or project manager (PM) of project management teams if it is in-house or PMC firms if externally appointed;

c. The in-house project management teams are formed for a specific project and are actively engaged in project management services from inception until project closed-out;

d. The PMC firms are registered with the Ministry of Finance Malaysia and are actively engaged in project management services from inception until project closed-out;

e. The respondents must have experience of not less than 10 years in the construction industry; and

f. The projects undertaken by the respondents are successful based on the perception of the respondents.

These criteria are very important to ensure the selection of suitable respondents who carry out the role of project directors and project managers of government projects and are involved throughout the project life cycle. Based on the above criteria, the respondents are project managers and project directors with more than 10 years experience from in-house project management teams in PWD, DID, and Ministry of Finance and if externally appointed are from active PMC firms registered with the Ministry of Finance Malaysia appointed for government projects. They are chosen as respondents because public sector projects are implemented through PWD, DID, other relevant government agencies and Ministry of Finance Malaysia as discussed in chapter 3.

Respondents from the government agencies are in-house project management teams specifically formed for special projects in the PWD, DID, and Ministry of Finance Malaysia. There are sixteen (16) special project teams comprising a total of thirty-four (34) project director and project managers. Out of this total, only twenty-six (26) project directors and project managers meet the criteria set for the respondents.

Respondents from the private sector are the PMC firms registered with the Ministry of Finance. There are a total of eighty (82) PMC firms registered with the Ministry of Finance, where seventy (70) firms are from Semenanjung Malaysia and twelve (12) firms are from Sabah and Sawarak. Since this study does not encompass Sabah and Sarawak, only the 70 firms from Semenanjung Malaysia are considered. All the 70 firms are contacted but upon further checking only thirty-seven (37) PMC firms are still active while the remaining thirty-three (33) PMC firms are either not active or not totally engaged in project management services. Within the 37 active firms, there are a total of hundred and two (102) project directors and project managers and out of that total, seventy-six (76) of them meet the criteria set for the respondents.

As such there is a total population of hundred and thirty-six (136) project directors and project managers comprising thirty-four (34) from in-house project management teams specifically formed for special projects in the PWD, DID, and Ministry of Finance Malaysia and hundred and two (102) from PMC firms registered with the Ministry of Finance. Out of this total, the respondents for this study is 102 project director and project managers which amount to seventy-five percent (75%) of the population. These respondents comprise twenty-six (26) project directors and project managers from in-house project management teams from PWD, DID and Ministry of

Finance Malaysia and seventy-six (76) project directors and project managers from PMC firms.

The population and respondents are shown graphically in Figure 4.5.

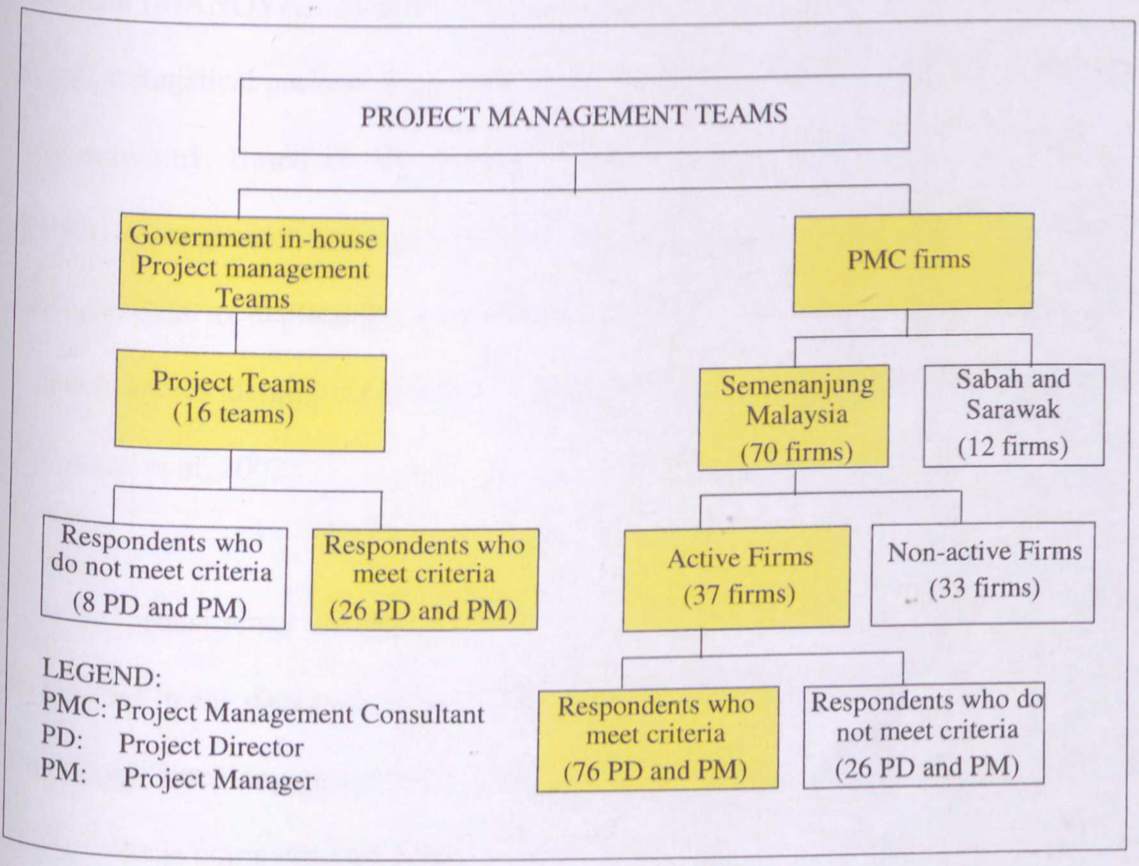


Figure 4.5: Respondents for this study

4.6 ANALYSIS OF DATA

Analysis of data would generate acceptable conclusive results through statistical means (Norusis, 1990) and able to construct a detail description of a phenomenon, to provide recommendations to the problems identified (Kamaruddin and Roslim, 1990). Edwards and Talbot (1999) note that for survey design, data analysis is mainly through descriptive statistics and some statistical testing.

In this study, data is analysed using the statistical package for social science (SPSS) software employing multivariate statistical analysis comprising factor analysis, descriptive statistics, Pearson's correlation coefficient, and multivariate analysis of variance (MANOVA). According to Zulkarnaian and Hishamuddin (2001), SPSS is a popular statistical package used in the field of science namely management, education and economy. Based on the literature review, majority of the previous studies in project management utilize multivariate statistical analysis. This method is able to analyze data to explain the relationship between the different variables of project success and to identify the key factors that would not be ascertained by other methods (Shenhar et al, 2002).

Internal consistency condition of the data set or internal coherence of data is important in any data evaluation (Hair et al, 1998, and Aripin, 2000). This condition is necessary since any comparative assessment to be valid it has to be made on equal basis, that is comparing like against like and that data are not bias. In this condition, whatever conclusion is derived should be able to reflect the correct situation of the problem being investigated. As such, in order to achieve the requirement of high level of trustworthiness of the research findings, internal consistency tests are performed on the data set. Data consistency is thus measured by the value of the alpha coefficient obtained. This means that the higher the value of the coefficients obtained the more consistent will be the data set. A mark below 0.70 is considered as lack of internal consistency (Nunally, 1978).

4.6.1 Factor analysis

Factor analysis is a mathematical procedure and is applied mainly to reduce the number of variables, to identify relationship or something in common between variables, and to classify or group these variables (Williams and Monge, 2001). This study applied factor analysis in identifying the grouping of the success factors and reduces a set of variables to a smaller number of variables or factors. The essential purpose of factor analysis is to describe, if possible, the covariance relationships among many variables in terms of a few underlying, but unobservable, random quantities called factors (Johnson and Wichern, 2002). It examines the pattern of intercorrelations between the variables, and determines whether there are subsets of variables or factors that correlate highly with each other but that show low correlations with other subsets or factors (Williams and Monge, 2001).

There are different methods of extracting the factors from a set of data such as principal components analysis, principal axis factoring, image factoring, maximum likelihood factoring, alpha factoring, unweighted least squares factoring, and weighted least squares factoring. The method chosen depends on the size of the samples, the number of variables and the communality estimates between variables. However, whichever methods used generally produce similar results (Statsoft, 2003).

The principal components analysis (PCA) to extract the factors is chosen for this study, as according to MSITStore (2007), PCA is often preferred when the main aim of the analysis is to detect or classify structure. PCA with a varimax rotation method is carried out through the SPSS factor program. This method transforms a set of variables into a new set of composite variables or principal components that are not correlated with each other. These linear combinations of variables, called factors, account for the variance in the data as a whole. The best combination makes up the first principal component and is the first factor. The second principal component is defined as the best linear combination of variables for explaining the variance not accounted for by the first factor. In turn, there may be a third, fourth and *k*th component, each being the best linear combination of variables not accounted for by the previous factors. The process continues until all the variances are accounted for.

Table 4.1 is the Measure of Sampling Adequacy (MSA) that provides the degree of intercorrelation among variables that ranges from 0 to 1. For any variable that scored below 0.5 is considered as inadequate and unacceptable (Jantan and Ramayah, 2006). Even the score of between 0.5 to 0.7 is not strong enough and considered as mediocre and miserable. Hair et al (1998) suggest the index of 0.70 or above as middling, hence is used in this study.

Table 4.1: Measure of Sampling Adequacy

Measure of Sampling Adequacy (MSA)	Comments
0.80 above	Meritorious
0.70 – 0.80	Middling
0.60 – 0.70	Mediocre
0.50 – 0.60	Miserable
Below 0.5	Unacceptable

Source: Jantan and Ramayah (2006)

In this study, thirty-three (33) success factors are subject to factor analysis. Initially, the appropriateness of factor analysis to be carried out is assessed through two statistical measurements; Kaiser-Meyer-Olkin (KMO) and the Bartlet's test of sphericity. The KMO index quantifies the degree of intercorrelations among the variables and the appropriateness of factor analysis.

The Bartlett's test of sphericity is a statistical test for the presence of correlations among the variables. It provides the statistical probability that the correlation matrix has significant correlations among at least some of the variables. The significant of the test (p-value <0.05) indicates that factor analysis is appropriate to be conducted. As shown in Table 4.2, the value of the KMO (0.747) exceeds the minimum acceptable level and the Bartlett test is significant (p-value<0.000) at 0.05 significance level. As a result, factor analysis is carried out.

Table 4.2: Summary statistics of KMO and Bartlett's test

KMO Measure of Sampling Adequacy		0.747
Bartlett's Test of Sphericity	Approx. Chi-Square	872.302
	Degree of freedom	153
	p-value	0.000

For the purpose of this study, four (4) factors are set to be extracted. The four factor groups extracted with their respective items, factor loadings, percent of variance, cumulative variance and reliability coefficients are summarised in Table 4.3. The factor group '*Human management*' contains eight factors with factor loadings ranged from 0.631 to 0.785. Eight factors load on the second group of '*Process*' with factor loadings ranged from 0.570 to 0.773. The third group '*Organization' is* made up of ten factors. Their factor loadings ranged in size from 0.517 to 0.737. Eight factors formed the fourth group '*Contract and technical*' with factor loadings ranged from 0.459 to 0.742. The fourth factor group explain 61.04% of the total sample variance. All factors are reasonably reliable as the Alpha's coefficients are above the threshold value of 0.70.

Table 4.3: Summary statistics of factor analysis and reliability coefficients

Factor Group	Individual factors	Factor Loading	% of Variance	Cumulative (%)	Alpha's Coefficient
Human management	Communication	0.785	33.074	33.074	0.930
	Project manager	0.770			
	Stakeholder management	0.744			
	Team and leadership	0.736			
	Project definition	0.676			
	Client consultation and acceptance	0.670			
	Performance, effectiveness and efficiency	0.656			
	Attitude, behaviour and commitment	0.631			
Process	Quality management	0.773	10.930	44.004	0.723
	Scheduling	0.767			
	Planning	0.743			
	Risk management	0.722			
	Monitoring and control	0.717			
	Documentation	0.677			
	Troubleshooting	0.648			
	Safety program	0.570			
Organization	Financial resources	0.737	9.942	53.946	0.875
	Policy and strategy	0.733			
	Learning organization	0.724			
	External environment	0.714			
	Organization structure	0.707			
	Empowerment	0.642			
	Culture	0.641			
	Top management support	0.621			
	Goal/ objective and mission	0.606			
	Resources and personnel	0.517			
Contract and Technical	Innovation	0.742	7.089	61.035	0.812
	Contractor	0.720			
	Technical	0.713			
	Contracting	0.710			
	Design	0.687			
	Estimate	0.610			
	Project characteristics	0.571			
	Technology	0.459			

As suggested by Jantan and Ramayah (2006), the score of above 0.70 is middling and as such is used in this study. Hence, based on the factor analysis, the significant factors that achieve a score of above 0.7 are adopted for this study. This is shown in Table 4.4.

Table 4.4: Significant success factors

Factor	Items	Factor Loading	Alpha's Coefficient
Human management	Communication	0.785	0.930
	Project manager	0.770	
	Stakeholder management	0.744	
	Team and leadership	0.736	
Process	Quality management	0.773	0.723
	Scheduling	0.767	
	Planning	0.743	
	Risk management	0.722	
	Monitoring and control	0.717	
Organization	Financial resources	0.737	0.875
	Policy and strategy	0.733	
	Learning organization	0.724	
	External environment	0.714	
	Organization structure	0.707	
Contract and Technical	Innovation	0.742	0.812
	Contractor	0.720	
	Technical	0.713	
	Contracting	0.710	

4.6.2 Descriptive statistics

Descriptive analysis converts raw data by rearranging, ordering and manipulating for easy interpretation (Zigmund, 2000). According to Johnson and Wichern (2002) a large set of data will be difficult to extract relevant information unless the data are assessed by a summary number, measure of location or central value, or a measure of spread or variation. Descriptive statistics provide such summary by calculating the percentages, frequency distribution, average, mean and standard deviation.

Even though Chan and Kumaraswamy (1997) opined that descriptive statistics namely the mean score does not reflect relationship between attributes and as such are not an appropriate technique to assess overall ranking, others disagree as they used the technique for such purpose. This technique is amongst that used in studies by Belassi and Tukel (1996), Hartman et al (1998), Hartman and Ashrafi (2002), Nguyen et al (2004), Collins and Baccarini (2004), Iyer and Jha (2005), and Wang and Huang (2005) to rank the success criteria and factors.

4.6.3 Correlation analysis

Correlation analysis establishes and describes the strength and direction of relationship between two variables. The common statistic methods are the Pearson correlation and Spearman's Rho correlation (Williams and Monge, 2001). The Pearson correlation is used when the data for the variables are interval and it measures the degree of linear relationship between two variables usually labeled X and Y. The Spearman's Rho correlation is used when the data for the variables are ordinal. While in regression, the emphasis is on predicting one variable from the other, in correlation the emphasis is on the degree to which a linear model may describe the relationship between two variables.

Correlation coefficients reveal the magnitude and direction of relationships (Cooper and Schindler, 2001). The sign of the correlation coefficient (+ , -) defines the direction of the relationship, either positive or negative. A positive correlation coefficient means that as the value of one variable increases, the value of the other variable increases; as one decreases the other decreases. A negative correlation coefficient indicates that as one variable increases, the other decreases, and vice-versa.

The computation of the Pearson product-moment correlation coefficient is as follows:

$$r_{yx} = \frac{\mathrm{cov}(y,x)}{\sqrt{\mathrm{var}(y) * \mathrm{var}(x)}}$$

where

Cov(y,x) = the covariance of y and x

Var(x)= the variance of x

Var(y)= the variance of y

This study applied Pearson's correlation coefficient to investigate the relationship between project success, project success criteria and project success factors. The interpretation of the values of correlation coefficients as compiled by Zakaria and Md Som (2001) is shown in Table 4.5. The interpretation of the values ranges from 0 to +/- 1, where the absence of a relationship is expressed by a coefficient of zero and a perfect positive or negative correlation is expressed by a coefficient of +/- 1.

Table 4.5: Interpretation of the values of correlation coefficient

Values of Correlation Coefficient (*r*)	Interpretations	
	Guilford (1956)	**Norusis (2002)**
0.0	-	No linear correlation
+/-0.0 to +/-0.2	Very weak correlation	Very weak correlation
+/-0.2 to +/-0.4	Low correlation	Weak correlation
+/-0.4 to +/-0.6 or +/-0.4 to +/-0.7	Medium correlation	Moderate correlation
+/-0.6 to +/-0.8 or +/-0.7 to +/-0.9	High correlation	Strong correlation
+/-0.8 to +/-1.0 or +/-0.9 to +/-1.0	Very high correlation	Very strong correlation
+/-1.0	-	Perfect positive or negative linear correlation

Source: Adapted from Zakaria and Md Som (2001)

4.6.4 Multivariate analysis of variance (MANOVA)

In this study, MANOVA is carried out to test whether there is a significant difference of perception of project success criteria and project success factors between respondents' demographic characteristics; years of experience, qualification, sector, type of project completed and position held.

The purpose of a *t* test is to assess the likelihood that the means for two groups are sampled from the same sampling distribution of means (Carey, 1998). The purpose of an analysis of variance (ANOVA) is to test whether the means for two or more groups are taken from the same sampling distribution. The multivariate equivalent of the *t* test is Hotelling's T2. Hotelling's T2 tests whether the two vectors of means for the two groups are sampled from the same sampling distribution. MANOVA is the multivariate analogue to Hotelling's *T*2. As such, the purpose of MANOVA is to test whether the vectors of means for the two or more groups are sampled from the same sampling distribution.

In MANOVA, the null hypothesis tested is equality of vectors of means on multiple dependent variables across groups (Hair et al, 1998). MANOVA examines similarities and differences among the multivariate mean scores of several populations. The null hypothesis for MANOVA is that all of the centroids (multivariate means) are equal: $H_o : \mu_1 = \mu_2 = \mu_3 = ...\mu_n$. The alternative hypothesis is that the vectors of centroids are unequal: $H_A : \mu_1 \neq \mu_2 \neq \mu_3 \neq ...\mu_n$. When the null hypothesis is rejected, additional tests are done to better understand the data. Cooper and Schindler (2001) considered some of the tests that are as follows;

i) Univariate *F* tests can be run on the dependent variables

ii) Simultaneous confidence intervals can be produced for each variable

For the multivariate test procedures of MANOVA to be valid, three assumptions must be met (Hair et al, 1998). These are: (1) the observations must be independent, (2) the variance-covariance matrices must be equal for all treatments and (3) the set of *p*-dependent variables must follow a multivariate normal distribution; that any linear combination of the dependent variables must follow a normal distribution. One of the common methods to test for normality is by conducting Kolmogorov-Smirnov test. The null and alternative hypotheses adopted are as follows:

H_o: The variable is normally distributed

H_1: The variable is not normally distributed

4.7 CONCLUDING REMARK

Chapter 4 described the methodology used for this thesis. This study involves the survey approach using structured questionnaire method. The research framework for this study comprises two phases namely the data collection and data analysis. Based on data collection, a theoretical framework is formulated by synthesizing the attributes of project success. Data are analyzed using the SPPS software employing multivariate statistical analysis comprising factor analysis, descriptive statistics, Pearson's correlation coefficient, and MANOVA.

The analyses on the preliminary study, through factor analysis, has assisted in identifying four (4) significant success criteria of time, cost and stakeholders' appreciation and eighteen (18) significant success factors that have been classified under the success factor groups of human management, process, organization, and contract and technical.

The following chapter presents the result of the field survey.

CHAPTER 5: ANALYSIS AND FINDINGS

5.0 INTRODUCTION

This chapter describes the analyses of data through the various multivariate statistical techniques and the discussion on the findings. Data collection for primary information is conducted through a questionnaire survey and is analysed using SPSS software.

There are three parts to the analyses. Firstly in paragraphs 5.1 and 5.2, the analyses are on the background of the respondents and the measurement of data to ensure consistency and validity. Secondly in paragraphs 5.3 and 5.4, the analyses are on the interpretation of the data with regards to project success criteria and success factors. This includes the correlation between success criteria and success factors and the test of significance of relationship between project success and its components. Thirdly in paragraphs 5.5 and 5.6, the analyses comprise testing of perception of project success criteria and success factors between demographic characteristics to see if there are significant differences.

5.1 BACKGROUND OF RESPONDENTS

Table 5.1 summarises the demographic characteristics of the respondents. The respondents are classified by years of experience, qualification, employment sector, types of project and their post within the project team. In terms of majority of the respondents, 59 respondents (57.8%) have a working experience of more than 20 years; 62 respondents (60.8%) are engineers, 76 respondents (74.5%) are employed in the private sector, 52 respondents (51.0%) are involved in education projects, and 75 respondents (73.5%) are project managers.

Table 5.1: Demographic characteristics of the respondents

Demographic	Characteristics	Frequency	Percentage (%)
Years of Experience	10 to 15 years 15 to 20 years More than 20 years	22 21 59	21.6 20.6 57.8
Qualification	Quantity Surveyor Architect Engineer Others	23 14 62 3	22.5 13.7 60.8 2.9
Sector	Government Private	26 76	25.5 74.5
Project completed	Education projects Health projects Housing projects Security projects Others	52 13 5 5 27	51.0 12.7 4.9 4.9 26.5
Project Team	Project Director Project Manager	27 75	26.5 73.5

As shown in Table 5.2, there are a total of 102 respondents where 76 (74.50%) are from private sector and 26 (25.50%) are from public sector. Most of the respondents are professionals namely 62 Engineers (60.78%), 23 Quantity Surveyors (22.55%), and 14 Architects (13.73%). The remaining 3 respondents (2.94%) are experienced sub-professionals. The total 102 respondents is taken through structured survey which represented the overall total population involved and the numbers are more than enough in statistical approach that require a minimum of 35 only.

Table 5.2: Number of respondents by sector and qualification

Sector	Qualification				Total
	Engineer	Quantity Surveyor	Architect	Others	
Government	20 (76.92%)	3 (11.54%)	3 (11.54%)	0 (0%)	26 (25.50%)
Private	42 (55.26%)	20 (26.32%)	11 (14.47%)	3 (3.95%)	76 (74.50%)
Total	62 (60.78%)	23 (22.55%)	14 (13.73%)	3 (2.94%)	102 (100%)

Since 80 respondents (78.43%) have more than 15 years experience (20.58% with 15 to 20 years experience, and 57.84% with more than 20 years experience) as shown in Table 5.3, it is expected that they will be able to provide accurate and reliable information. The experience of the remaining 22 respondents (21.57%) is within the period of 10 to 15 years.

Table 5.3: Number of respondents by qualification and years of experience

Qualification	Years of Experience			Total
	10 to 15 years	15 to 20 years	More than 20 years	
Engineer	14 (22.58%)	10 (16.13%)	38 (61.29%)	62 (100%)
Quantity Surveyor	6 (26.09%)	6 (26.09%)	11 (47.83%)	23 (100%)
Architect	2 (14.29%)	3 (21.43%)	9 (64.29%)	14 (100%)
Others	0 (0%)	2 (66.67%)	1 (33.33%)	3 (100%)
Total	22 (21.57%)	21 (20.59%)	59 (57.84%)	102 (100%)

Table 5.4 shows the breakdown by projects undertaken by the respondents. Majority of the projects are building projects comprising 73.53% and others which are mainly infrastructure projects comprise 26.47% of the total projects managed by respondents.

Table 5.4: Number of respondents by sector and project completed

Sector	Project completed					Total
	Education Projects	Health Projects	Housing projects	Security Projects	Others	
Government	1 (3.85%)	10 (38.46%)	1 (3.85%)	1 (3.85%)	13 (50.00%)	26 (100%)
Private	51 (67.11%)	3 (3.95%)	4 (5.26%)	4 (5.26%)	14 (18.42%)	76 (100%)
Total	52 (50.98%)	13 (12.75%)	5 (4.90%)	5 (4.90%)	27 (26.47%)	102 (100%)

Table 5.5 identifies the positions of the respondents in the projects undertaken. The result in the table shows that 75 of the respondents (73.53%) are project managers and the remaining 27 respondents (26.47%) are project directors.

Table 5.5: Number of respondents by project completed and team position

Project completed	**Position in the Project team**		Total
	Project director	Project manager	
Education project	9 (17.31%)	43 (82.69%)	52 (100%)
Health project	4 (30.77%)	9 (69.23%)	13 (100%)
Housing project	1 (20.00%)	4 (80.00%)	5 (100%)
Security project	1 (20.00%)	4 (80.00%)	5 (100%)
Others	12 (44.44%)	15 (55.56%)	27 (100%)
Total	27 (26.47%)	75 (73.53%)	102 (100%)

5.2 INTERNAL CONSISTENCY OF THE SCALE

In this research, the response captured pertaining to the project success criteria and project success factors are ranked using scale of order of importance. The least important is assigned the value of 1 and the most important the value of 5. Hence, the high value of the scale suggests importance and alternatively, the low value of the scale reflects non significance of importance as perceived by the respondents. Then for each of items being considered, the Cronbach's alpha coefficients are calculated as shown in Table 5.6. For this purpose, the cut-off point of 0.70 is used as the benchmark.

Table 5.6: Reliability coefficients

Variable	Number of items	Cronbach's alpha
Project success	4	0.892
Time	3	0.713
Cost	3	0.714
Quality	3	0.795
Stakeholders' appreciation	3	0.852
Human management	4	0.930
Process	5	0.723
Organization	5	0.875
Contract and technical	4	0.812
Team and leadership	3	0.747
Project manager	3	0.791
Communication	3	0.767
Stakeholder management	3	0.791
Planning	3	0.795
Scheduling	3	0.759
Monitoring and control	3	0.724
Quality management	3	0.815
Risk management	3	0.886
Organization structure	3	0.713
Financial resources	3	0.737
Policy and strategy	3	0.802
Learning organization	3	0.852
External environment	3	0.808
Contracting	3	0.741
Contractor	3	0.744
Technical	3	0.759
Innovation	3	0.847

As can be seen in Table 5.6, all items investigated records alpha coefficients of greater than 0.70. Hence, it can be concluded that the data sets are consistent and therefore reflect highly of the reliability and validity of the comparisons and assessments made.

5.3 CRITERIA AND FACTORS OF PROJECT SUCCESS

5.3.1 Project success criteria

Four project success criteria of time, cost, quality, and stakeholders' appreciation have been identified. In the survey, the respondents are asked on the importance of these four success criteria using the scale of 1 to 5. The mean of these values are then computed. The result in Table 5.7 shows that the respondents agree all the four success criteria are important considering that all the criteria recorded a mean score of above 4. The mean score for '*Quality*' is 4.32, for '*Stakeholders' appreciation*' is 4.17, for '*Time*' the mean score is 4.09 and for '*Cost*' it is 4.04.

Table 5.7: Importance of the success criteria

Criteria	Mean score
Quality	4.32
Stakeholders' appreciation	4.17
Time	4.09
Cost	4.04

Detailed evaluation on each of the descriptions pertaining to the four criteria as described above is given in Table 5.8. The mean scores for each description within the success criteria are computed. Within the '*Quality*' criterion, the most important description is '*complete as required by specifications, drawings, etc*' with a mean score of 4.62; followed by '*good workmanship and minimum defects*' and '*minimum scope change*' with a mean score of 4.33 and 4.01 respectively. In terms of '*Stakeholders' appreciation*' criterion, '*stakeholders' satisfaction*' is considered as the most important recording the highest mean score of 4.58; followed by '*meet client's objective and requirement*' with a mean score of 4.33 and '*yield profit, business and other benefits*' with a mean score of 3.62.

For the '*Time*' criterion, '*complete on or before date of completion*' with a mean score of 4.49 is the most important followed by '*delays rectified*' and '*minimum extension of time*' with a mean score of 3.99 and 3.80 respectively. For the '*Cost*' criterion '*complete within budget*' with a mean score of 4.36 is the most important followed by '*minimum claim*' with a mean score of 3.94 and '*minimum variation*' with a mean score of 3.82.

Table 5.8: Mean scores for each description of the success criteria

Rank	Criteria/ Description	Mean Score
	Quality	
1	Complete as required by specifications, drawings, etc.	4.62
2	Good workmanship and minimum defects	4.33
3	Minimum scope change	4.01
	Stakeholders' appreciation	
1	Stakeholders' satisfaction	4.58
2	Meet client's objectives and requirements	4.33
3	Yield profit, business and other benefits	3.62
	Time	
1	Complete on or before date of completion	4.49
2	Delays rectified	3.99
3	Minimum extension of time	3.80
	Cost	
1	Complete as budgeted	4.36
2	Minimum claims	3.94
3	Minimum variation	3.82

Since all the four success criteria are considered important, then all these criteria are being taken into account in the next question to the respondents. The respondents are required to rank, using the scale of 1 to 5, of what they perceived as the important success criteria for the successful completion of project. The mean of these values are then computed and then ranked accordingly. The results are as shown in Table 5.9. At the top most of the scale of preference is '*Stakeholders' appreciation*' with the mean value of 4.18. This is followed by '*Quality*' and '*Time*' with a mean score of 3.98 and 3.88 respectively. The lowest preference level is '*Cost*' with a mean score of 3.65.

Table 5.9: Ranking of project success criteria

Rank	Criteria	Mean score
1	Stakeholders' appreciation	4.18
2	Quality	3.98
3	Time	3.88
4	Cost	3.65

Since the ranking is vital to this study, another set of questions with similar intention is put forward to the respondents in the form of comparing two criteria against each other. The respondents are required to agree or disagree, using the scale of 1 to 5, on statements that compare the importance of one criteria over another. The overall means for each of these criteria are computed and ranked. Although the value of the mean scores are slightly different from that of Table 5.9 above but similar results are obtained in which '*Stakeholders' appreciation*' is ranked highest, followed by '*Quality*', '*Time*' and '*Cost*' as shown in Table 5.10.

Table 5. 10: Ranking of project success criteria

Rank	Criteria	Mean score
1	Stakeholders' appreciation	3.47
2	Quality	3.32
3	Time	2.77
4	Cost	2.49

The ranking of these success criteria is further analysed in term of the perception of respondents from the government and the private sectors as shown in Table 5.11. Both respondents in the government and private sectors ranked '*Stakeholders' appreciation*' as the most important success criterion. However, the next two criteria of importance are ranked oppositely. Respondents in government sector perceive criterion of '*Quality*' while it is the criterion of '*Time*' for respondents in private sector. '*Cost*' is ranked as the least important by respondents from both sectors.

Table 5.11: Ranking of success criteria by sectors

Success criteria	Sector	
	Government	Private
Stakeholders' appreciation	1	1
Quality	2	3
Time	3	2
Cost	4	4

Note: The value in each cell is the rank

The analysis is further carried out based on the years of experience of respondents. There seems to be slight difference of perception between the categories. Table 5.12 reveals that those with 15 to 20 years of experience and with more than 20 years of experience give similar ranking on the importance of success criteria. However, the ranking of importance is different by respondents with relatively less experience (10 to 15 years). The former ranked '*Stakeholders' appreciation*' while the latter ranked '*Quality*' and '*Time*' as the most important success criteria. Interestingly, all respondents ranked '*Cost*' as the least important criterion.

Table 5.12: Ranking of success criteria by years of experience

Success criteria	Years of Experience		
	More than 20 years	15 – 20 years	10 - 15 years
Stakeholders' appreciation	1	1	2
Quality	2	2	1
Time	3	3	1
Cost	4	4	3

Note: The value in each cell is the rank

5.3.2 Project success factors

Following the analysis on the success criteria, the next stage is the analysis on the success factors. Respondents are required to rank the relative importance of these factors in achieving the success criteria. The result is as shown in Table 5.13. The analysis shows that to achieve the success criteria, the success factor of '*Human management*' is considered as the most important being highest ranked with a mean score of 4.44. This is followed by the success factors of '*Process*' and '*Contract and technical*' with a mean score of 3.77 and 3.36 respectively. Comparatively the least important success factor is '*Organization*' with a mean score of 2.97.

Table 5.13: Ranking of success factor

Success factor	Mean score
Human management	4.44
Process	3.77
Contract and technical	3.36
Organization	2.97

The ranking of these project success factors is further analysed in term of the perception of respondents from the government and private sectors. The factors are ranked based on the mean score and the result is summarised in Table 5.14. Both respondents in the government and private sectors ranked '*Human management*' as the most important success factor. However, the second most important success factor is ranked differently by both respondents. Respondents in government sector perceive the factor of '*Process*' while '*Contract and technical*' factor for respondents in private sector. The opposite ranking is for the third most important criterion. Lastly, '*Organization*' is equally ranked as the least important by respondents from both sectors.

Table 5.14: Ranking of success factor by sectors

Success factor	Sector	
	Government	Private
Human Management	1	1
Process	2	3
Contract and technical	3	2
Organization	4	4

Note: The value in each cell is the rank

Table 5.15 summarises the ranking of the project success factors according to years of experience of respondents. Regardless of years of experience that ranges from 10 to more than 20 years experience, it is observed that the respondents perceived '*Human management*' as the most important success factor followed by '*Process*', '*Contract and technical*', and '*Organization*'.

Table 5.15: Ranking of success factors by years of experience

Success factor	Years of Experience		
	10 to 15 years	15 to 20 years	More than 20 years
Human Management	1	1	1
Process	2	2	2
Contract and technical	3	3	3
Organization	4	4	4

Note: The value in each cell is the rank

5.3.3 Success factors within the factor groups

Within each of the four success factor groups, the mean score of individual factors are ranked in order of importance as perceived by the respondents. The results are given in Table 5.16.

Table 5.16: Ranking of individual factors within the factor groups

Rank	Success factors	Mean Score	Average
	Human Management		4.41
1	Team and leadership	4.68	
2	Project manager	4.43	
3	Communication	4.37	
4	Stakeholder management	4.16	
	Process		4.05
1	Monitoring and control	4.24	
2	Planning	4.10	
3	Scheduling	4.02	
4	Quality management	3.95	
5	Risk management	3.95	
	Contract and technical		3.90
1	Contracting	4.24	
2	Contractor	4.18	
3	Technical	4.03	
4	Innovation	3.25	
	Organization		3.70
1	Organization structure	4.27	
2	Financial resources	3.83	
3	Policy and strategy	3.82	
4	Learning organization	3.53	
5	External environment	3.17	

For the success factor group of '*Human management*', with an average mean score of 4.41, the factor '*Team and leadership*' is considered as the most important, followed by '*Project manager, Communication, and Stakeholder management*'. For the success factor group of '*Process*', with an average mean score of 4.05, the factor '*Monitoring and control*' is the most important, followed by '*Planning, Scheduling, Quality management, and Risk management*'. For the success factor group of '*Contract and technical*, with an average mean score of 3.90, the factor '*Contracting*' is the highest ranked, followed by '*Contractor, Technical, and Innovation.* And for the success factor group of '*Organization*', with an average mean score of 3.70, the factor '*Organization structure*' is the highest ranked, followed by the factors of '*Financial resources, Policy and strategy, Learning organization, and External environment*'.

5.3.4 Correlation between success criteria and success factors

Table 5.13 in paragraph 5.3.2 shows the ranking of the success factor to achieve the overall success criteria. The ranking is based on the computation of the mean scores for each factor within Table 5.17. Detailed evaluation on the four success factors to achieve each of the success criteria is as shown in Table 5.17. For the success criteria of *'Stakeholders' appreciation'*, *'Quality'* and *'Cost'*, the ranking of importance of the success factors are *'Human management'*, followed by *'Process'*, *'Contract and technical'* and *'Organization'*. However, a slight difference is observed for the ranking of the success factors to achieve the *'Time'* criterion. As in other criteria, the success factors of *'Human management'* and *'Process'* are still ranked as most important but the factor of *'Organization'* has been ranked higher than the factor of *'Contract and technical'*.

Table 5.17: Ranking of success factors for each success criteria

Rank	Criteria/Factors	Mean Score
	Stakeholders' appreciation	
1	Human management	4.57
2	Process	3.62
3	Contract and technical	3.25
4	Organization	3.08
	Quality	
1	Human management	4.39
2	Process	3.90
3	Contract and technical	3.56
4	Organization	2.77
	Time	
1	Human management	4.51
2	Process	3.80
3	Organization	3.19
4	Contract and technical	3.02
	Cost	
1	Human management	4.29
2	Process	3.78
3	Contract and technical	3.63
4	Organization	2.86

5.4 INVESTIGATING THE RELATIONSHIP BETWEEN PROJECT SUCCESS, SUCCESS CRITERIA AND SUCCESS FACTORS

5.4.1 Project success and project success criteria

In this analysis the correlation coefficients are calculated between project success and the project success criteria as shown in Table 5.18. When the relevant correlation tests are performed, the results obtained show that significant relationships are registered between project success and all the project success criteria. Based on the coefficients, it can be concluded that the success of the project is highly related to all the criteria of '*Stakeholders' appreciation*'; '*Quality*', '*Time*' and '*Cost*'.

Table 5.18: Relationship between project success and project success criteria

Relationship	Pearson's coefficient of correlation	Significant correlation
Project success and Stakeholders' appreciation	0.697**	High
Project success and Quality	0.633**	High
Project success and Time	0.633**	High
Project success and Cost	0.608**	High

**Correlation is significant at the 0.01 level (2-tailed).

5.4.2 Project success factors and stakeholders' appreciation

The level of the relationship of the project success factors and '*Stakeholders' appreciation*' are tested and the results are tabulated below (Table 5.19). Similarly, the significant relationship exists between the variables. The result reveals that '*Stakeholders' appreciation*' is highly correlated with '*Human management*' followed by '*Process*', '*Organization*' and '*Contract and technical*'.

Table 5. 19: Relationship between project success factors and Stakeholders' appreciation

Relationship	Pearson's coefficient of correlation	Significant correlation
Stakeholders' appreciation and Human management	0.804**	Very high
Stakeholders' appreciation and Process	0.789**	High
Stakeholders' appreciation and Organization	0.748**	High
Stakeholders' appreciation and Contract and technical	0.742**	High

**Correlation is significant at the 0.01 level (2-tailed).

5.4.3 Project success factors and quality

Further analyses are conducted on the data sets, where the Pearson's coefficient correlation between '*Quality*' and the project success factors. The data obtained shows significant relationship between '*Quality*' and each of the success factors investigated. '*Quality*' 'is found to be highly correlated with *Human management*' followed by '*Process*', '*Contract and technical*' and '*Organization*' as shown in Table 5.20.

Table 5.20 Relationship between project success factors and quality

Relationship	Pearson's coefficient of correlation	Significant correlation
Quality and Human management	0.804**	Very high
Quality and Process	0.789**	High
Quality and Contract and technical	0.748**	High
Quality and Organization	0.742**	High

**Correlation is significant at the 0.01 level (2-tailed).

5.4.4 Project success factors and time

The next test involved the project success factors and '*Time*' in which the result is given in Table 5.21. The result reveals that significant correlation exists between '*Time*' and all the success factors. It is found that '*Time*' is highly correlated with '*Human management*', '*Process*', '*Contract and technical*' and lastly '*Organization*'.

Table 5.21: Relationship between project success factors and time

Relationship	Pearson's coefficient of correlation	Significant correlation
Time and Human management	0.753**	High
Time and Process	0.739**	High
Time and Contract and technical	0.727**	High
Time and Organization	0.711**	High

**Correlation is significant at the 0.01 level (2-tailed).

5.4.5 Project success factors and cost

The relationship between '*Cost*' and project success factors are tested and the result is as shown in Table 5.22. Similarly, there are significant correlations between '*Cost*' and the success factors. Based on the coefficient '*Human management*' has the highest correlation, followed by '*Process*', '*Contract and technical*' and '*Organization*'.

Table 5.22: Relationship between project success factors and cost

Relationship	Pearson's coefficient of correlation	Significant correlation
Cost and Human management	0.753**	High
Cost and Process	0.739**	High
Cost and Contract and technical	0.727**	High
Cost and Organization	0.711**	High

**Correlation is significant at the 0.01 level (2-tailed).

5.5 TESTING FOR DIFFERENCES IN PERCEPTION OF PROJECT SUCCESS CRITERIA BETWEEN DIFFERENT DEMOGRAPHIC CHARACTERISTICS

This section aims to find out whether there exist any differences in the perception pertaining to each of the success criterion between respondents' demographic characteristics that include years of experience, professional qualifications, different sectors namely public and private sectors, type of project completed and position held by the respondents. Therefore, the multivariate analysis of variance (MANOVA) seems to be appropriate as there are multiple dependent variables.

The results of Kolmogorov-Smirnov test are presented in Table 5.23 which shows that all variables being investigated are normally distributed with the corresponding *p*-values found to be not significant since the *p*-value is more than 0.05 (*p*-values > 0.05).

Table 5.23: Kolmogorov-Smirnov test of normality

Variable	Statistic	*p*-value
Project success	0.130	0.117
Time	0.121	0.200
Cost	0.088	0.150
Quality	0.156	0.061
Stakeholders' appreciation	0.969	0.131

The assumption of the equality of variance-covariances matrices can be checked through the Box's M test. The nonsignificant of the test (*p*-values > 0.05) indicates the equality of variance-covariances matrices across the groups. The results of the test for all groups (demographic characteristics) are summarised in Table 5.24.

Table 5.24: Box's M test of equality of variance-covariances matrices

Group	Statistic	*p*-value
Years of experience	10.320	0.412
Qualification	16.144	0.168
Sector	12.804	0.285
Type of project	9.23	0.445
Position held	18.22	0.078

The results of the Box's M test for all groups are not significant (*p*-value > 0.05), indicating the variance-covariances matrices are equal. Since both assumptions are not violated, the analysis proceeded with the multivariate analysis of variance.

Using the Wilk's Lambda statistic, the result in Table 5.25 shows that there seems to be some differences in the perception of project success criteria between years of experience. Test on the overall means for each criterion shows that, with the exception of '*Time*' criterion, there is no difference among the means of '*Cost*', '*Quality*' and '*Stakeholders' appreciation*'.

Table 5.25: Tests of equality of vector of means between years of experience

Criteria	Years of Experience	Mean	F	*p*-value	Significant difference
Time	10 to 15 years	3.9848	3.697	0.028	Yes
	15 to 20 years	3.9048			
	more than 20 years	4.2034			
Cost	10 to 15 years	4.0303	2.535	0.084	No
	15 to 20 years	3.7937			
	more than 20 years	4.1356			
Quality	10 to 15 years	4.3030	2.089	0.129	No
	15 to 20 years	4.1429			
	more than 20 years	4.3898			
Stakeholders' Appreciation	10 to 15 years	4.1364	1.157	0.319	No
	15 to 20 years	4.0476			
	more than 20 years	4.2373			
Wilk's Lambda	0.908		1.185	0.030	Yes

To determine which level of experience that contributes towards the difference in the mean in the '*Time*' criterion the Bonferonni multiple comparison tests of significant is performed (Table 5.26). The test result reveals that respondents with more than 20 years of experience have a different perception on the factor of '*Time*' compared to those with 15 years to 20 years of experience.

Table 5.26: The Bonferonni multiple comparison tests

Criteria	Years of experience		Mean Difference	*p*-value	Significant difference
Time	10 to 15	15 to 20	0.0801	1.000	No
	More than 20	10 to 15	0.2185	0.218	No
	More than 20	15 to 20	0.2986	0.050	Yes

Similar tests are performed on the means of the levels of importance as perceived by the professionals for each criterion investigated. Using the Wilk's Lambda statistic, the result in Table 5.27 shows that there is no significant difference in the perception of project success criteria between different professionals. Test on the overall means for each criterion shows that there is no difference among the means of '*Time*', '*Cost*', '*Quality*' and '*Stakeholders' appreciation*'.

Likewise, the multivariate analysis of variance tests are performed on the means of the levels of importance as perceived by the different sectors for each of the criteria investigated. The results of the tests between the government and private sectors are given in Table 5.28. Using the Wilk's Lambda statistic, the result in Table 5.28 shows that there is no significant difference in the perception of project success criteria between different sectors. Test on the overall means for each criterion shows that there is no difference among the means of '*Time*', '*Cost*', '*Quality*' and '*Stakeholders' appreciation*'.

Table 5.27: Tests of equality of vector of means between qualification levels

Criteria	Qualification	Mean	F	*p*-value	Significant difference
Time	Quantity Surveyor Architect Engineer Others	4.1159 4.2143 4.0753 3.7778	0.722	0.541	No
Cost	Quantity Surveyor Architect Engineer Others	4.1159 4.1667 4.0215 3.3333	1.732	0.165	No
Quality	Quantity Surveyor Architect Engineer Others	4.3623 4.1667 4.3548 4.0000	1.079	0.362	No
Stakeholders' Appreciation	Quantity Surveyor Architect Engineer Others	4.1739 4.2143 4.1774 4.0000	0.141	0.935	No
Wilk's Lambda	0.900		0.855	0.594	No

Table 5.28: Tests of equality of vector of means between sectors

Criteria	Sector	Mean	F	*p*-value	Significant difference
Time	Government Private	4.1795 4.0658	1.022	0.314	No
Cost	Government Private	4.0256 4.0482	0.027	0.871	No
Quality	Government Private	4.4359 4.2807	2.022	0.158	No
Stakeholders' appreciation	Government Private	4.1538 4.1842	0.068	0.795	No
Wilk's Lambda	0.940		1.540	0.197	No

The multivariate analysis of variance tests are also performed on the means of the levels of importance on project types for each of the criteria investigated. The results of the tests based on project types are given in Table 5.29. Using the Wilk's Lambda statistic, the result in Table 5.29 shows that there is no significant difference in the perception of project success criteria between different project types. Test on the overall means for each criterion shows that there is no difference among the means of '*Time*', '*Cost*', '*Quality*' and '*Stakeholders' appreciation*'.

Table 5.29: Tests of equality of vector of means between types of project

Criteria	Type of project	Mean	F	*p*-value	Significant difference
Time	Education projects	3.9872	1.770	0.141	No
	Health projects	4.0513			
	Housing projects	4.3333			
	Security projects	4.2667			
	Others	4.2469			
Cost	Education projects	4.0769	1.489	0.211	No
	Health projects	3.9231			
	Housing projects	3.4667			
	Security projects	4.2000			
	Others	4.1111			
Quality	Education projects	4.2628	0.721	0.580	No
	Health projects	4.3846			
	Housing projects	4.5333			
	Security projects	4.5333			
	Others	4.3210			
Stakeholders' appreciation	Education projects	4.1346	2.270	0.067	No
	Health projects	3.9231			
	Housing projects	4.6000			
	Security projects	4.4000			
	Others	4.2593			
Wilk's Lambda		0.662	2.599	0.100	No

Lastly the multivariate analysis of variance tests are performed on the means of the levels of importance as perceived by the position held by the respondents for each of the criteria investigated. The results of the tests based on the position held by the respondents are given in Table 5.30. Using the Wilk's Lambda statistic, the result in Table 5.30 shows that there is no significant difference in the perception of project success criteria between the positions held by the respondents. Test on the overall means for each criterion shows that there is no difference among the means of '*Time*', '*Cost*', '*Quality*' and '*Stakeholders' appreciation*'.

Table 5.30: Tests of equality of vector of means between position level in the project

Criteria	Position	Mean	F	*p*-value	Significant difference
Time	Project Director Project manager	4.1111 4.0889	0.040	0.843	No
Cost	Project Director Project manager	4.1481 4.0044	1.113	0.294	No
Quality	Project Director Project manager	4.2593 4.3422	0.584	0.447	No
Stakeholders' appreciation	Project Director Project manager	4.2099 4.1644	0.156	0.694	No
Wilk's Lambda	0.964		0.917	0.457	No

As noted from each of the tables 5.27, 5.28, 5.29 and 5.30 the results show that the factors are normally distributed. The results of the Wilk's Lambda generally indicate that there is no difference between the means pertaining to each of the criteria, whether based on the qualifications, or by sectors, or by types of projects, or by the position of the respondents. In summary, except for the time criterion, the result shows that there is no significant difference in the perception of project success criteria between the different demographic characteristics.

5.6 TESTING FOR DIFFERENCES IN PERCEPTION OF PROJECT SUCCESS FACTORS BETWEEN DIFFERENT DEMOGRAPHIC CHARACTERISTICS

In Section 5.5 investigations are performed to determine the perception of the respondents pertaining to each of the success criteria based on years of experience; qualification; sectors; project types and the positions of the respondents. Similarly, this section uses similar mean vectors tests or MANOVA on the success factors. Firstly, the assumptions of normality and equality of variance-covariance matrices are assessed. Referring to Table 5.31, the nonsignificant of the Kolmogorov-Smirnov test for the success factors indicates that they are normally distributed.

Table 5.31: Kolmogorov-Smirnov test of normality

Variable	Statistic	*p*-value
Human management	0.147	0.099
Process	0.222	0.179
Contract and technical	0.137	0.160
Organization	0.148	0.093

The nonsignificant of the Box's M test for all groups as shown in Table 5.32 concluded that the success factors have no significant differences of variance-covariance matrices.

Table 5.32: Box's M test of equality of variance-covariances matrices

Group	Statistic	*p*-value
Years of experience	10.320	0.412
Qualification	16.144	0.168
Sector	12.804	0.285
Type of project	9.23	0.445
Position	18.22	0.078

As a result, MANOVA is carried out as the assumptions are met. Tests are performed on the perception of project success factors between years of experience and the results are shown in Table 5.33. The results of the Wilk's Lambda test on the overall means for each of the attributes show that there is no difference among the means of '*Human management*', '*Process*', '*Organization*' and '*Contract and technical*'.

Table 5.33: Tests of equality of vector of means between years of experience

Factor	Years of Experience	Mean	F	*p*-value	Significant difference
Human Management	10 to 15 years	3.7841	1.534	0.221	No
	15 to 20 years	3.7500			
	more than 20 years	3.6271			
Process	10 to 15 years	3.5455	1.516	0.225	No
	15 to 20 years	3.3333			
	more than 20 years	3.3119			
Organization	10 to 15 years	3.2091	0.058	0.944	No
	15 to 20 years	3.2476			
	more than 20 years	3.2136			
Contract and Technical	10 to 15 years	3.6818	0.264	0.769	No
	15 to 20 years	3.6190			
	more than 20 years	3.6271			
Wilk's Lambda	0.870		1.729	0.094	No

Similar tests are performed on the means of the levels of importance as perceived by the professionals for each of the success factors investigated. The results of the tests between different professionals are given in Table 5.34. Using the Wilk's Lambda statistic, the result in Table 5.34 shows that there is no significant difference in the perception of project success factors between different professionals. Test on the overall means for each factor shows that there is no difference among the means of '*Human management*', '*Process*', '*Organization*' and '*Contract and technical*'.

Table 5.34: Tests of equality of vector of means between qualification levels

Factor	Qualification	Mean	F	*p*-value	Significant difference
Human Management	Quantity Surveyor Architect Engineer Others	3.6522 3.6964 3.6734 4.1667	1.494	0.221	No
Process	Quantity Surveyor Architect Engineer Others	3.4261 3.3143 3.3548 3.4000	0.142	0.935	No
Organization	Quantity Surveyor Architect Engineer Others	3.1913 3.1714 3.2387 3.2667	0.146	0.932	No
Contract and technical	Quantity Surveyor Architect Engineer Others	3.5978 3.5714 3.6573 3.8333	0.738	0.532	No
Wilk's Lambda	0.814		1.692	0.069	No

Likewise, the multivariate analysis of variance tests are performed on the means of the levels of importance as perceived by the different sectors for each of the factors investigated. The results of the tests between the government and private sectors are given in Table 5.35. Using the Wilk's Lambda statistic, the result in Table 5.35 shows that there is no significant difference in the perception of project success factors between different sectors. Test on the overall means for each factor shows that there is no difference among the means of '*Human management*', '*Process*', '*Organization*' and '*Contract and technical*'.

The multivariate analysis of variance tests are also performed on the means of the levels of importance on project types for each of the factors investigated. The results of the tests based on project types are given in Table 5.36. Using the Wilk's Lambda statistic, the result in Table 5.36 shows that there is no significant difference in the perception of project success factors between different project types. Test on the overall means for each factor shows that there is no difference among the means of '*Human management*', '*Process*', '*Organization*' and '*Contract and technical*'.

Table 5.35: Tests of equality of vector of means between types of project

Factor	Type of project	Mean	F	*p*-value	Significant difference
Human Management	Education projects	3.6971	0.171	0.953	No
	Health projects	3.6923			
	Housing projects	3.8000			
	Security projects	3.6500			
	Others	3.6481			
Process	Education projects	3.4269	0.437	0.782	No
	Health projects	3.3385			
	Housing projects	3.4400			
	Security projects	3.2400			
	Others	3.2741			
Organization	Education projects	3.2077	0.027	0.999	No
	Health projects	3.2154			
	Housing projects	3.2400			
	Security projects	3.2400			
	Others	3.2370			
Contract and technical	Education projects	3.6298	0.062	0.993	No
	Health projects	3.6731			
	Housing projects	3.6500			
	Security projects	3.6000			
	Others	3.6389			
Wilk's Lambda	0.930		0.434	0.973	No

Table 5.36: Tests of equality of vector of means between sectors

Factor	Sector	Mean	F	*p*-value	Significant difference
Human Management	Government	3.5962	1.725	0.192	No
	Private	3.7171			
Process	Government	3.1846	3.954	0.049	No
	Private	3.4289			
Organization	Government	3.1462	1.059	0.306	No
	Private	3.2447			
Contract and Technical	Government	3.5769	1.201	0.276	No
	Private	3.6579			
Wilk's Lambda	0.958		1.071	0.375	No

Lastly the multivariate analysis of variance tests are performed on the means of the levels of importance as perceived by the position held by the respondents for each of the factors investigated. The results of the tests based on the position held by the respondents are given in Table 5.37. Using the Wilk's Lambda statistic, the result in Table 5.37 shows that there is no significant difference in the perception of project success factors between the positions held by the respondents. Test on the overall means for each factor shows that there is no difference among the means of '*Human management*', '*Process*', '*Organization*' and '*Contract and technical*'.

Table 5.37: Tests of equality of vector of means between position level in the project

Factor	**Position**	**Mean**	**F**	***p*-value**	**Significant difference**
Human Management	Project Director Project manager	3.7130 3.6767	0.157	0.693	No
Process	Project Director Project manager	3.3852 3.3600	0.041	0.839	No
Organization	Project Director Project manager	3.2593 3.2053	0.322	0.571	No
Contract and Technical	Project Director Project manager	3.6481 3.6333	0.041	0.840	No
Wilk's Lambda	0.995		0.127	0.972	No

As noted from each of the tables 5.33, 5.34, 5.35, 5.36 and 5.37 the results show that the factors are normally distributed. The results of the Wilk's Lambda indicate that there is no difference between the means pertaining to each of the factors, whether based on the years of experience, or qualifications, or by sectors, or by types of projects, or by the position of the respondents. In summary, the result shows that there is no significant difference in the perception of project success factors between the different demographic characteristics.

5.7 CONCLUDING REMARK

Chapter 5 describes the analysis and result of the study and thus provides the empirical findings with regards to project success. The findings of the study reveals that '*Stakeholders' appreciation*' is found to be relatively the most important project success criteria among the respondents. This is followed by the criteria of '*Quality*' and '*Time*'. The least consideration is given to the '*Cost*' criterion. The Pearson's correlation coefficient shows that there is generally high and significant correlation between project success and all the success criteria. In addition, except for the criterion of '*Time*' the MANOVA tests generally indicate that there is no significant difference in the perceptions of the project success criteria based on different demographic characteristics.

With regards to success factors, the analysis ranked '*Human management*' as the critical success factor, followed by '*Process*', '*Contract and technical*' and '*Organization*'. Besides that, the analysis suggests team and leadership as the highest ranked factor within the factor group of '*Human management*'; monitoring and control as the highest ranked factor within the factor group of '*Process*'; contracting as the highest ranked factor for the factor group of '*Contract and technical*', and organization structure as the highest ranked factor within the factor group of '*Organization*'. The Pearson's correlation coefficient shows that there is generally high and significant correlation between project success and all the success factors. In addition, the MANOVA tests generally indicate that there is no significant difference in the perceptions of the project success factors based on different demographic characteristics.

On the subject of correlation of success factors in achieving each of the success criteria, the analysis ranked *'Human management'* as the most important. With the exception of the criterion of *'Time'* the ranking of the other success factors is in the following order of importance: *'Process', 'Contract and technical'* and *'Organization'*. The criterion of *'Time'* seems to place more importance on the success factor *'Organization'* over *'Contract and technical'*.

In summary, the highest ranked project success criterion is *'Stakeholders' appreciation'*; the highest ranked project success factor group is *'Human management'*; and the highest ranked project success factor group to achieve each of the success criteria is likewise *'Human management'*.

The following chapter presented the conclusion and recommendation consequential to the findings of the study.

CHAPTER 6: CONCLUSION AND RECOMMENDATION

6.0 INTRODUCTION

The main aim of this study has been to contribute to debates on the definition and components of project success. In particular, it examines the significant success criteria and critical success factors of project success through the perspective of the respondents namely the project directors and project managers in the construction industry implementing public sector projects.

This chapter draws conclusion regarding the findings of the study in relation to the objectives and the research statement and proposes recommendations for the Malaysian construction industry and future research area.

6.1 ASSESSING THE FINDINGS OF THE STUDY

The construction industry has always been dubbed as the engine of growth for any nation building. This is due to the fact that the construction industry stimulates domestic economic activities. Both the public sector through the various socio-economic policies and the private sector provide development of construction projects. These construction projects create a multiplier effect on other sectors of the economy namely the manufacturing, mining, agriculture and services sectors by being a large user of manufactured construction building materials, energy, fuel, agro-based products, and professional services. In addition, upon completion of the construction projects, these development and properties in turn generate weath to the citizen of the nation.

In Malaysia there has never been a stop in development of construction projects especially government projects. Federal government development expenditure for the 6^{th} until 9^{th} Malaysia Plan from the year 1990 until 2010 is in excess of RM600 billion. This reflect the government's spending and commitment in nation building which spurred the construction industry. The construction sector growth trend mirrors the cycle of the gross development product of the nation. However, how important is contruction industry to nation building it is beset with inefficiences. Studies and reports have highlighted below average performance, time delay, cost overrun, and poor quality to the extent that failures in the construction industry is seem as customary with a low probability of successful implementation.

The importance of the construction industry through its vital link to the gross development product and nation building, necessitates construction projects implemented achieved project success. The question of how to achieve project success depends on what constitutes project success. However there seems to be a knowledge gap with regards to project success. Firstly, there is no definitive description of project success. Although there are numerous literature on project success but since 1950's until now there exist confusion over the definition of project success. Scholars seem to agree that there is no consensus on what constitutes project success as there is no standard or common term for its definition. From the early identification of time, cost and quality as a definition of project success, researchers have added many other outcomes and objectives. Towards the turn of the century these elements of project success are differentiated as success criteria and success factors. However the definition is further aggravated as the terms used for success criteria and success factors are interchangeable or at times intertwine.

Secondly, there is no consensus on the critical success factors. Scholars agree that managing the many success factors required to achieve project success are impractical and unachievable and advocate Pareto principle by identifying and choosing appropriate key success factors and expend all energy on them. However eventhough there are several studies being carried out there is no agreement on what comprises these critical success factors. In addition, there are few empirical studies carried out in the construction industry and particularly fewer still in the context of the Malaysian construction industry.

In addition, although there are abundant literature on project success yet there is comparatively little empirical data and previous studies provide too general or too specific success factors that are difficult to be applied in practice. In Malaysia apart from the few studies on success criteria and project management success there is no empirical study on what constitute project success in the context of Malaysian construction industry.

This study identifies the critical success factors that can be adopted for the construction industry in Malaysia. This is in line with Jiang et al (1996), Cleland (1999), and Lui (2004) who postulate that a set of generic or common critical success factors can be identified for an industry.

The findings of this study are based on the respondents' perception and viewpoint and it is recognized that different stakeholders may hold different views. Although Lui (2004) states that these set of critical success factors based on the respondents' perceptions are the threat of bias, Cooke-Davies (2002) qualifies that the identification of success factors are accurate and acceptable if they are based on factors that consistently emerge in project management success and project success. This study is meticulous in the selection of suitable respondents who are directly involved in the successful implementation of projects. Nonetheless, a simple study has been carried out to validate the findings, the write-up and result of the validation exercise as shown in Appendix 13 generally supports the findings of this study.

The main objectives of the study are as follows:

1. To develop the components of project success.
2. To find significant project success criteria by ranking the criteria.
3. To find significant project success factors.
4. To identify the dominant critical success factors by ranking the factors.
5. To correlate the project success factors to project success criteria.

The research statement of this study is 'Human management is critical in the construction industry to ensure project success'. Thus, the assessment of the findings of this study is to achieve the objectives and to substantiate the research statement of the study as provided below:

6.1.1 Objective No. 1: To develop the components of project success

Based on the data collection and data analysis, the component of project success is encapsulated in Project Success Framework as shown in Figure 6.1. Project success comprises two components namely the project success criteria and the project success factors.

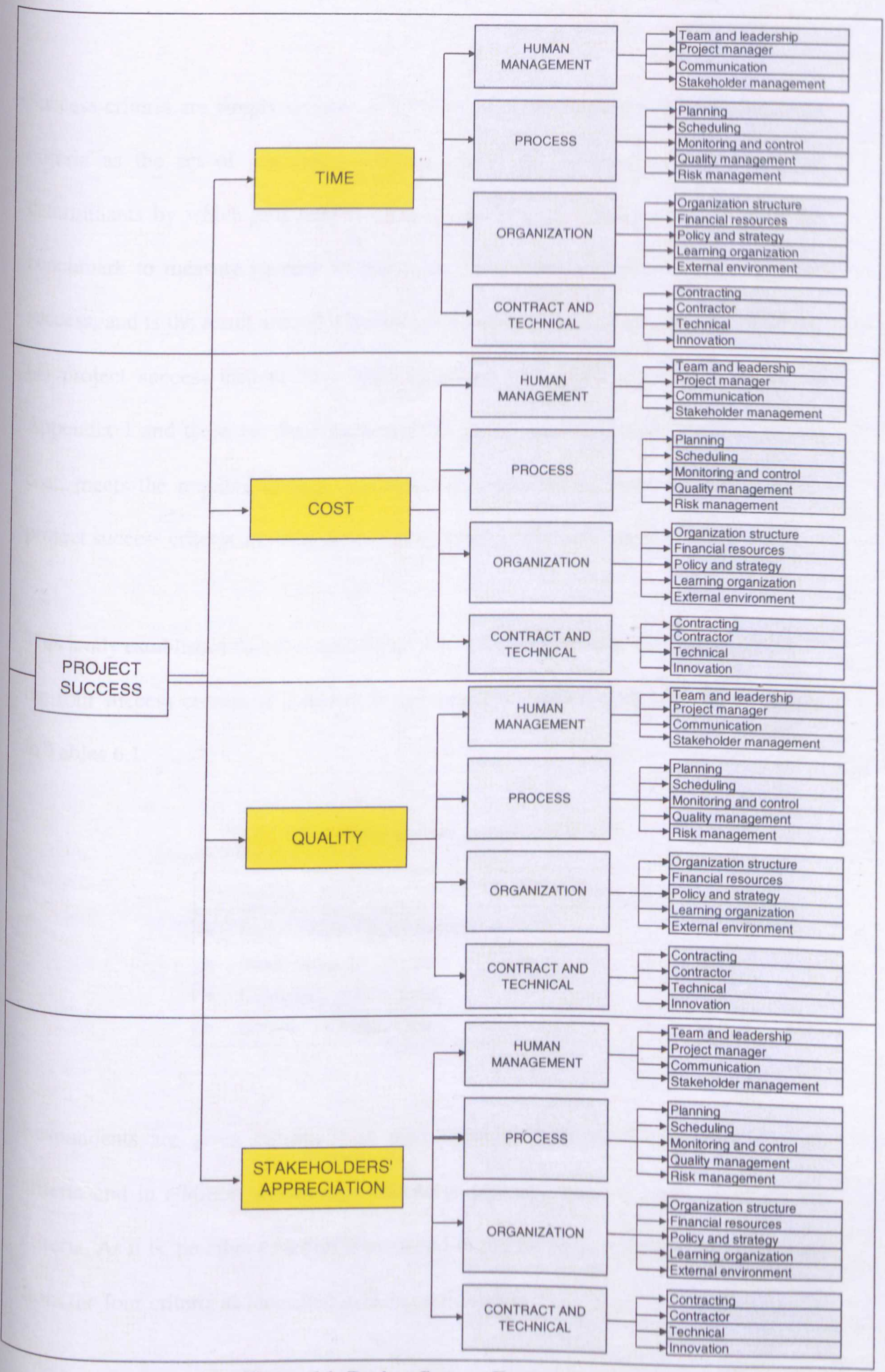


Figure 6.1: Project Success Framework

Success criteria are simply termed as "What to achieve". Researchers define success criteria as the set of principles, standards, level of performance, dimensions or determinants by which judgment is made on the project. These criteria became the benchmark to measure success or failure. It is the criteria used to assess a project success, and is the result area of what are to be achieved thus termed the 'What'. Four (4) project success criteria have been identified by various authors as shown in Appendix 1 and these are the achievement of project completion within time, within cost, meets the required quality, and achieving stakeholders' appreciation. In brief, project success criteria are time, cost, quality and stakeholders' appreciation.

This study establishes that the respondents are in agreement with the importance of all the four success criteria of stakeholder appreciation, quality, time and cost as shown in Tables 6.1.

Table 6.1: Project success criteria/'WHAT'

SUCCESS CRITERIA (WHAT TO ACHIEVE)
• Stakeholders' appreciation • Meets required Quality • Completes within Time • Completes within Cost

Respondents are given options if in their opinion, there should be other success criteria and in addition should they choose to provide comments and views on the criteria. As it is, no other criterion is proposed or put forward by the respondents apart from the four criteria as identified in the questionnaire.

Success factors are simply termed as "How to achieve'. Researchers define success factors as those elements that are required to deliver the success criteria. These elements are the set of circumstances, forces, facts or influences, levers, essential activities and key variables. These also include knowledge, skill, trait, motive, attitude, value or other personal characteristics essential to perform the required task. They contribute to the result or the achievement of the success criteria and increase the likelihood of project success. These success factors are not the basis of measurement or judgment but management inputs, systems, and behavior that would lead to project success, and are the organizational areas of how to achieve the success criteria and thus termed the 'How'.

The findings of this study identify eighteen (18) significant success factors (as further discussed in paragraph 6.1.3) that are classified under four (4) factor groups of human management, process, organization, and contract and technical. This study reveals that the respondents are in agreement with the identification of the success factor groups as shown in Table 6.2.

SUCCESS FACTOR GROUPS (HOW TO ACHIEVE)
• Human management • Process • Organization • Contract and technical

Table 6.2: Project success factor groups/ 'HOW'

Table 6.3 demonstrates that to achieve the success criteria, the identified success factor groups have to be in place. Similarly, respondents are given options if in their opinion, there should be other success factors and in addition should they choose to provide comments and views on the factors. As it is, no other factor is proposed or put forward by the respondents apart from the success factors as identified in the questionnaire.

Hence, this study postulates that project success is achieving the success criteria of stakeholder's appreciation, completion as specified quality, on time and within cost, through the success factors of human management, process, contract and technical and organization.

6.1.2 Objective No. 2: To find significant success criteria by ranking the criteria

The findings of this study establish the significance of all the four (4) project success criteria as shown in Table 6.3.

Table 6.3: Ranking of Project success criteria

RANKING	SUCCESS CRITERIA
1	Stakeholders' appreciation
2	Meets required Quality
3	Completes within Time
4	Completes within Cost

The ranking of the success criteria are as follows: '*Stakeholders' appreciation*', '*Quality*', followed by *'Time'* and *'Cost'*. The ranking of success criteria is identical with the study in the construction industry in China conducted by Wang and Huang (2005). In addition, the choice of '*Stakeholders' appreciation*' as the critical criteria is consistent with other studies that are conducted by Hartman et al (1998), White and Fortune (2002), and Collins and Baccarani (2004).

Even though this study indicates generally that the ranking of these criteria is somewhat similar, there seems to be slight differences based on two demographic characteristics namely the different sectors and experience of respondents.

Firstly, the difference between the public and private sector respondents is the preference for '*Quality*' as compared to '*Time*' criterion. The preference of '*Quality*' over '*Time*' by the respondents in the public sector seems to indicate that the end result of the project is more important as opposed to the duration of the project. Respondents from the private sector ranked the criterion of '*Time*' over '*Quality*' appears to give the impression that completion of work within the duration of the contract period takes priority over quality of the work. This is shown in Figure 6.4.

Table 6.4: Ranking of success criteria by sectors

Success criteria	**Sector**	
	Government	Private
Stakeholders' appreciation	1	1
Quality	2	3
Time	3	2
Cost	4	4

Note: The value in each cell is the rank

Secondly, the difference between respondents with more than 15 years experience and those with 10 to 15 years experience is the preference of '*Stakeholders' appreciation*' as compared to '*Quality*' and '*Time*' criteria. The preference of '*Stakeholders' appreciation*' by the more experienced respondents seems to indicate that as the project managers or directors gain more experience they tend to value the stakeholders more. This is shown in Table 6.5.

Table 6.5: Ranking of success criteria by years of experience

Success criteria	Years of Experience		
	More than 20 years	15 – 20 years	10 - 15 years
Stakeholders' appreciation	1	1	2
Quality	2	2	1
Time	3	3	1
Cost	4	4	3

Note: The value in each cell is the rank

6.1.3 Objective No.3: To find significant success factors.

Literature review has identified thirty-three (33) project success factors as shown in Table 6.6.

Table 6.6: Project success factors

PROJECT SUCCESS FACTORS	
1. Attitude, behavior and commitment	18. Performance, effectiveness and efficiency
2. Client consultation and acceptance	19. Planning
3. Contracting	20. Policy and strategy
4. Contractor	21. Project manager
5. Communication	22. Project characteristic
6. Culture	23. Project definition
7. Design	24. Quality management
8. Documentation	25. Resources and personnel
9. Empowerment	26. Risk management
10. Estimate	27. Safety program
11. External environment	28. Schedule
12. Financial resources	29. Stakeholder management
13. Goal/ objective and mission	30. Team and leadership
14. Innovation	31. Technical
15. Learning organization	32. Top management support
16. Monitoring and control	33. Troubleshooting
17. Organization structure	

The finding of the preliminary study validates eighteen (18) project success factors as significant out of the thirty-three (33) project success factors that has been identified as shown in Table 6.7.

Table 6.7: Significant Project success factors

PROJECT SUCCESS FACTORS	
1.	Team and leadership
2.	Project manager
3.	Communication
4.	Stakeholder management
5.	Monitoring and control
6.	Planning
7.	Scheduling
8.	Quality management
9.	Risk management
10.	Contracting
11.	Contractor
12.	Innovation
13.	Technical
14.	Organization structure
15.	Financial resources
16.	Policy and strategy
17.	Learning organization
18.	External environment

The study further grouped these project success factors into four (4) success factor groups as it was pointed that instead of analysing each individual success factors, it is the combined effects of the individual success factors that are grouped would eventually lead to project success.

These factor groups are derived based on the management philosophy that would enable the stakeholders of the construction industry to relate to the managerial aspect of their organization namely '*Human management*', '*Process*', and '*Organization*'. In addition, the success factor group of '*Contract and technical*' is included to take into cognizance the quintessence of the construction industry. The eighteen (18) significant success factors grouped under the factor groups are shown in Table 6.8.

Table 6.8: Grouping of significant success factors

Success factor groups	Success factors
Human management	Team and leadership Project manager Communication Stakeholder management
Process	Monitoring and control Planning Scheduling Quality management Risk management
Contract and Technical	Contracting Contractor Innovation Technical
Organization	Organization structure Financial resources Policy and strategy Learning organization External environment

Respondents are given options if in their opinion, there should be other significant success factors and in addition should they choose to provide comments and views on these significant factors. As it is, no other factor is proposed or put forward by the respondents apart from those identified in the questionnaire.

6.1.4 Objective No.4: To identify the dominant critical success factors by ranking the factors.

The findings of this study reveal that the ranking of the success factor groups as shown in Table 6.9. Table 6.9 shows the ranking of the success factor groups is as follows: '*Human management*', '*Process*', '*Contract and technical*' and '*Organization*'. Hence, the dominant critical success factor group is human management as it has been ranked highest.

Table 6.9: Ranking of success factor groups

Ranking	Success factor
1	Human management
2	Process
3	Contract and technical
4	Organization

The study also indicates that the ranking of these factor groups is somewhat similar even between different demographic characteristics of sectors and experience as shown in Table 6.10.

Table 6.10: Ranking of success factor by sectors

Success factor	**Sector**	
	Government	Private
Human Management	1	1
Process	2	3
Contract and technical	3	2
Organization	4	4

Note: The value in each cell is the rank

However, there is a slight difference between the perception of the respondents from public and private sectors namely the preference for '*Process*' as compared to '*Contract and technical*'. The preference of '*Process*' by the respondents from public sector seems to indicate that the means or procedure and the course of actions taken to achieve any objective are more critical as opposed to the contractual and technical execution of the project. Respondents from the private sector ranked the factor of '*Contract and technical*' over '*Process*' appears to give the impression that the contractual obligations and technical matters takes precedence over whatever processes that have been established for the execution of the project.

In addition, the study reveals the ranking of the individual success factors within the factor groups as shown in Table 6.11.

Table 6.11: Ranking of individual factors within the factor groups

Rank	Success factors
	Human Management
1	Team and leadership
2	Project manager
3	Communication
4	Stakeholder management
	Process
1	Monitoring and control
2	Planning
3	Scheduling
4	Quality management
5	Risk management
	Contract and technical
1	Contracting
2	Contractor
3	Technical
4	Innovation
	Organization
1	Organization structure
2	Financial resources
3	Policy and strategy
4	Learning organization
5	External environment

Within the success factor group of *'Human management'*, the success factor *'Team and leadership'* is ranked highest followed by *'Project manager, Communication and Stakeholder management'*. Within the success factor group of *'Process'*, the success factor of *'Monitoring and control'* is ranked highest over *'Planning, Scheduling, Quality management and Risk management'*. For the success factor group of *'Contract and technical'*, *'Contracting'* is the highest ranked compared to *'Contractor, Technical and Innovation'*. And lastly, the success factor group of *'Organization'*, *'Organization structure'* is the highest ranked compared to *'Financial resources, Policy and strategy, Learning organization, and External environment'*.

6.1.5 Objective No.5: To correlate the project success factors to project success criteria.

The findings of this study as shown in Table 6.12 reveal two suppositions as follows:

a) Generally, the ranking of the success factors in achieving each success criterion is similar. This is consistent with the findings of the studies by Belassi and Tukel (1996), Chua et al (1999), and Asif (2004).

b) Apart from the success criterion of time, the success factor groups in order of ranking are generally similar to the findings of objective 3 that is '*Human management*', '*Process*', '*Contract and technical*' and '*Organization*'. As for the time criterion, the preference is for '*Organization*' over '*Contract and technical*'.

Table 6.12: Ranking of success factors for each success criteria

Rank	Criteria/Factors
	Stakeholders' appreciation
1	Human management
2	Process
3	Contract and technical
4	Organization
	Quality
1	Human management
2	Process
3	Contract and technical
4	Organization
	Time
1	Human management
2	Process
3	Organization
4	Contract and technical
	Cost
1	Human management
2	Process
3	Contract and technical
4	Organization

In correlating the success factors to each success criterion, the result indicates the importance of human management over other factors. It can be inferred that human management is the dominant critical success factor in achieving the success criteria.

6.1.6 Research statement

The research statement of this study is 'Human management is critical in the construction industry to ensure project success'. Based on the result and analysis of the study above, the success factor of '*Human management*' seems to be dominant in all aspect in achieving the success criteria of stakeholders' appreciation, quality, time and cost.

The construction industry is a very technical oriented industry. The stakeholders require relevant qualifications and technical training to be able to contribute to the implementation of projects. The consultants comprising architects, mechanical engineers, electrical engineers and quantity surveyors must possess the relevant professional qualifications. In addition, they must be registered with their relevant professional Boards in order to practice and provide professional services. The contractors' supervisory staff, semi-skilled laborers and even laborers require special technical trainings and accredited by the Construction Industry Development Board Malaysia. The statutory authorities that approved the development and building plans comprising the professionals such as architects, engineers and building surveyors must possessed the relevant professional qualifications.

However, since this study reveals that human management is the dominant critical success factor over other factors, it is imperative that not only technical qualifications are required but issues with regard to human or people. In addition, as team and leadership has been revealed as the most important factor in the success factor group of human management, this issue needs to be emphasized in the training of the industry players and stakeholders in the construction industry. Apart from team and leadership, due recognition must be given with regard to the project manager training, communication issues and stakeholder management.

6.2 PROBLEMS ENCOUNTERED

This study does not encounter many complex problems. The main problems occurred in developing the theoretical framework and during the field survey. The difficulty in the formulation of the theoretical framework is to capture the numerous and different ranging variables of project success as postulated by various researches and showing the relationship between these variables. The challenge is in making the framework simple enough to be understood but multifaceted enough that would show correlation.

The problems during the field survey are due to the changed of the respondents' addresses and the difficulty in fixing appointments due to their busy schedule. These are overcome by relying on networking between fellow project managers and persistently pursuing the respondents. In addition, some respondents' may have different understanding of the structured questionnaires and as such, the method of face-to-face interview has the advantage of giving the opportunity to explain to the respondents directly and immediately and maintaining the motivation and cooperation of the respondents.

6.3 RECOMMENDATION

The findings of the study suggest several ways to improve the likelihood of achieving project success. Stakeholders especially project managers need to be cognisant of the fact that project success is derived from knowing the criteria of "What to achieve" and the factors of "How to achieve". The success criteria comprise stakeholders' appreciation, quality, time and cost. The success factors comprise four factor groups of human management, process, contract and technical, and organization.

As such, it is recommended that any training module on project management is to include all the elements of success criteria and success factors. One such prime training module conducted by the Construction Industry Development Board Malaysia is the "Certified construction project manager training and accreditation program". The main objective of the program is to provide a training module that would produce qualified project manager who meets industry competency standard. It is thus suggested that such training modules be reviewed to ensure all that is encapsulated in the project success framework of this study are covered by the training courses. This proposal has been forwarded to the Construction Industry Development Board Malaysia and it has been agreed that due emphasis on the elements as suggested by the study will be given.

The findings also suggest that the dominant success criterion is stakeholders' appreciation and the critical success factor is human management. Both the criterion and factor deal with human factor. As such, project manager should be mindful of the fact that although the construction industry is a technically oriented industry but the project manager is dealing with stakeholders whose perception may not be based solely on technical criteria. It is thus recommended that curriculum for professional degree especially project management program to include issues regarding stakeholders' appreciation and human management. This includes the soft skills of leadership, teamwork, communication and stakeholder management. This proposal has been forwarded to the Ministry of Higher Education.

6.4 FUTURE RESEARCH

This research is a study of public sector projects in Malaysia. It is acknowledged that the findings may defer for private sector projects. In addition, this study has been presented in national seminars, training and lecture sessions and many participants from private sectors have shown interest for a general outlook of project success to include private sector projects. As such it is recommended that for future research, a similar study be carried out for private sector projects. This will complete the research on project success for construction projects implemented in Malaysia

This study has also been presented at international congresses and it was most favourably received. Suggestions and requests had been forwarded by international participants some of whom encourage the author to offer the completed study at the international level as they believe the research deserve a wider audience. It is thus recommended that for future research, a similar study be carried out for a global outlook and perspective.

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Appendix 1: Project success criteria by various authors

Success Criteria	Authors
Time, Cost and Quality	Angelides (1999), Asif (2004), Avots (1969), Arora (1995), Baccarini (1999), Belout (1998), Belassi and Tukel (1996), Bently and Rafferty (1992), Blaney (1989), Cleland (1999), Chan et al (2002), Chan (2004), Chua et al (1999), Christian (1993), Collins and Baccarini (2004), Cheung et al (2000), Diallo and Thuillier (2004), De Wit (1988), Duncan (1987), Dvir (2005), Fowler and Walsh (1998), Forger (2004), Frigenti and Comninos (2002), Garret (2000), Gray (2001), Hatush and Skitmore (1997), Hartman et al (1991), Ives (2005), Iyer and Jha (2005), Jang and Lee (1998), Kartam et al (2000), Kendra and Taplin (2004), Kleim and Ludin (1992), Kerzner (2003), Kin (2004), Lee-Kelley and Loong (2002), Lynch and Cloutier (2003), Milosevic and Patanakul (2005), Morris and Hough (1987), McCoy (1986), Nguyen et al (2004), Pinto and Slevin (1988), Phua (2004), Pocock et al (1997), Rad (2003), Redmill (1990), Russel and Jaselskis (1997), Songer and Molennar (1997), Soderlund (2004), Shenhar et al (2002), Skulmoski and Hartman (1999), Thomas et al (2002), Turner (1993), Wateridge (1998), Westerveld (2003), White and Fortune (2002), Yang et al (1997), and Zipf (1999)
Stakeholders' appreciation	Asif (2004), Arora (1995), Baccarini (1999), Belassi and Tukel (1996), Czuchry and Yasin (2004), Chan et al (2002), Chan (2004), Chua et al (1999), Crawford and Pollack (2004), Collins and Baccarini (2004), Diallo and Thuillier (2004), De Wit (1988), Dvir (2005), Fowler and Walsh (1998), Glass (1999), Gray (2001), Hartman et al (1991), Iyer and Jha (2005), Jang and Lee (1998), Kendra and Taplin (2004), Kleim and Ludin (1992), Kerzner (2003), Lynch and Cloutier (2003), Milosevic and Patanakul (2005), Morris and Hough (1987), Nguyen (2004), Rad (2003), Songer and Molennar (1997), Soderlund (2004), Shenhar et al (2002), Skulmoski and Hartman (1999), Turner (1993), Wateridge (1998), Westerveld (2003), White and Fortune (2002), Yang et al (1997)

Appendix 2: Success factors identified by various authors

	Various authors	Success factors
1	Cleland (1988), Wateridge (1998), Belout (1998), Campbell and Baker (2007)	Stakeholder management
2	De Wit (1988)	Stakeholder, external environment, contractor, objective, technical, and effectiveness and efficiency
3	Pinto and Prescott (1988)	Project mission, client consultation, and top management support.
4	Pinto and Slevin (1989)	Project mission, top management support, schedule, client consultation and acceptance, personnel, technical, monitoring and control, communication and troubleshooting
5	Kay (1993)	Innovation
6	Graham (1996)	Effectiveness and efficiency
7	Belassi and Tukel (1996)	Project manager, project team, project characteristic, organizational structure, top management support, external environment, estimate, resources, client consultaion, and financial resources
8	Liu and Walker (1998)	Goals, behaviour, and performance
9	Turner (1999)	Project definition, financial resources, schedule, planning, monitoring and control, quality management, risk management, team and leadership, attitudes and commitment, external environment, organization structure, resources, contract, and strategy
10	White and Fortune (2002)	Goals or objectives, top management support, financial resources, schedule, and commitment
11	Shenhar et al (2002)	Contractor, monitoring, design, quality management, project manager, project definition, schedule, design, documentation, policy, and client
12	Hartman and Ashrafi (2002)	Client consultation and acceptance, communication, project mission, and top management support
13	Cooke-Davies (2002) and Turner et al (2003)	Learning organization
14	Westerveld (2003)	Schedue, financial resources, organization structure, risk management, quality management, policy and strategy, stakeholder management, resources, contracting, and team and leadership
15	Asif (2003)	Project mission, planning, monitoring and control, client acceptance, and technical
16	Jiang and Heiser (2004)	External environment, project characteristic, stakeholder management, communication, monitoring and control
17	Chan et al (2004)	Communication, monitoring and control, planning, organization structure, safety program, quality management, project characteristic, external environment, contracting, stakeholder management, and team and leadership
18	Kendra and Taplin (2004)	Project manager, planning, schedule, monitoring and control, team and leadership, communication, performance, stakeholder management, and culture
19	Kanter and Walsh (2004)	Project definition, schedule, project manager, project team, and monitoring and control
20	Nguyen et al (2004)	Project manager, financial resources, project team, commitment, and resources
21	Chan (2004)	Planning, schedule, monitoring and control, team and leadership, project manager, contractor, and project characteristic.
22	Jugdev and Muller (2005)	Culture, empowerment, and client
23	Henrie and Sousa-Poza (2005)	Culture
24	Iyer and Jha (2005)	Project manager, top management support, monitoring and control, commitment, and stakeholder
25	Campbell and Baker (2007)	Planning, organization, monitoring and control, and resources
26	Nokes and Kelly (2007), Muller and Turner (2007)	Project manager

Appendix 3: Classification or grouping of success factors by various authors

	Authors	Classification or grouping of success factors
1	Rockart (1982)	Service, Communication, Human resources and Functions
2	Schultz et al (1987)	Strategic and Tactical
3	Magal et al (1988)	Commitment, Quality of service, Facilitation of end-user, Role clarity and Coordination of end-user
4	Young (1994)	Process factors and Project factors
5	Belassi and Tukel (1996)	Factors related to Project, Project manager and team, Organization, Client, Resources and External environment
6	Jang and Lee (1998)	Characteristics of client organization, Commitment of team members and Consultation mode
7	Chua et al (1999)	Project characteristics, Contractual arrangements, Project participants and Interactive processes
8	Chan et al (2001)	Project team commitment, Contractor's competencies, Risk and liability assessment, Client's competencies, End-users' needs and Constraints imposed by end-users
9	Clarke (2002)	Hard and Soft
10	Chan et al (2004)	Project-related factors, Procurement-related factors, Project management factors, Project participants-related factors and External factors
11	Nguyen et al (2004)	Comfort, Competence, Commitment and Communications
12	Milosevic and Patankul (2005)	Standardized project management tools, Standardized project leadership and Standardized project management process

Appendix 4: Project success factors (Human management) by various authors

Success Factors: HUMAN MANAGEMENT	Authors
Team and leadership	Appelbaum (2004), Arora (1995), Baccarini (1999), Barnes and Wearne (1993), Belassi and Tukel (1996), Bently and Rafferty (1992), Campobasso and Hosking (2004), Chan et al (2001), Chan et al (2004), Christian (1993), Cheung et al (2001), Cleland (1999), Chua et al (1999), Clarke (1999), Cooke-Davies (2002), De Wit (1988), Garret (2000), Hoegl and Gemuenden (2001), Iyer and Jha (2005), Jang and Lee (1998), Jefferies et al (2002), Judgev and Muller (2005), Jiang and Heiser (2004), Kanter and Walsh (2004), Kartam et al (2000), Kendra and Taplin (2004), Kirby (1996), Kleim and Ludin (1992), Lidow (1999), Longman and Mullins (2004), Magal et al (1988), Morris and Hough (1987), Milosevic and Patanakul (2005), Munns and Bjeirmi (1996), Nicolini (2001), Nitithamyong and Tan (2007), Nguyen et al (2004), Odusami et al (2002), Pate-Cornell and Dillon (2001), Prabhakar (2005), Pinto and Slevin (1988), Pinto and Slevin (1989), Phua (2004), Raiden et al (2004), Rao (2001), Rad (2003), Rockart (1982), Sotirou and Wittmer (2001), Shenhar et al (2002), Skulmoski and Hartman (1999), Thite (1999), Tiong (1996), Thamhain (2004), Turner and Muller (2005), Turner (2004), Westerveld (2003), Wateridge (1995), White and Fortune (2002), and Zika-Viktorsson et al (2003).
Project manager	Avots (1969), Belassi and Tukel (1996), Campobasso and Hosking (2004), Ceran (1995), Chan et al (2004), Christian (1993), Chua et al (1999), Cooke-Davies (2002), Iyer and Jha (2005), Jefferies et al (2002), Judgev and Muller (2005), Kendra and Taplin (2004), Kleim and Ludin (1992), Longman and Mullins (2004), Milosevic and Patanakul (2005), Munns and Bjeirmi (1996), Nitithamyong and Tan (2007), Nguyen et (2004), Pinto and Slevin (1988), Rockart (1982), Sotirou and Wittmer (2001), Shenhar et al (2002), Turner and Muller (2005), Turner (2004), Verner and Evanco (2005), and Walton (1984).
Communication	Avots (1969), Appelbaum (2004), Arora (1995), Baccarini (1999), Barnes and Wearne (1993), Belassi and Tukel (1996), Bently and Rafferty (1992), Ceran (1995), Chan et al (2001), Chan et al (2004), Christian (1993), Chua et al (1999), Clarke (1999), Hayfield (1979), Delisle and Olson (2004), Finch (2003), Forger (2004), Hartman and Ashrafi (2002), Hartman et al (1991), Hoegl and Gemuenden (2001), Iyer and Jha (2005), Jefferies et al (2002), Judgev and Muller (2005), Jiang and Heiser (2004), Kanter and Walsh (2004), Kendra and Taplin (2004), Kleim and Ludin (1992), Kwak (2002), Lidow (1999), Longman and Mullins (2004), Magal et al (1988), Morris and Hough (1987), Milosevic and Patanakul (2005), Nguyen et al (2004), Pinto and Slevin (1988), Pinto and Slevin (1989), Phua (2004), Rad (2003), Rockart (1982), Soderlund (2004), Turner (1994), Thamhain (2004), Verzuh (1999), Westerveld (2003), Wateridge (1995), White and Fortune (2002), Zipf (1999), and Zika-Viktorsson et al (2003)

Appendix 4: Project success factors (Human management) by various authors (cont'd)

Success Factors: HUMAN MANAGEMENT	Authors
Stakeholder management	Avots (1969), Appelbaum (2004), Arora (1995), Baccarini (1999), Barnes and Wearne (1993), Belassi and Tukel (1996), Bently and Raffety (1992), Campobasso and Hosking (2004), Ceran (1995), Chan et al (2001), Chan et al (2004), Christian (1993), Cheung et al (2001), Cleland (1999), Chua et al (1999), Clarke (1999), Cooke-Davies (2002), Czuchry and Yasin (2004), De Wit (1988), Delisle and Olson (2004), Duggan and Blayden (2001), Finch (2003), Forger (2004), Garret (2000), Gray (2001), Hartman and Ashrafi (2002), Hartman et al (1991), Hoegl and Gemuenden (2001), Iyer and Jha (2005), Jang and Lee (1998), Jefferies et al (2002), Judgev and Muller (2005), Jiang and Heiser (2004), Kanter and Walsh (2004), Kartam et al (2000), Kendra and Taplin (2004), Kerzner (2000), Kirby (1996), Kleim and Ludin (1992), Kwak (2002), Lidow (1999), Longman and Mullins (2004), Lynch and Cloutier (2003), Magal et al (1988), Morris and Hough (1987), Milosevic and Patanakul (2005), Munns and Bjeirmi (1996), Nicolini (2001), Nitithamyong and Tan (2007), Nguyen et al (2004), Odusami et al (2002), Pate-Cornell and Dillon (2001), Prabhakar (2005), Pinto and Slevin (1988), Pinto and Slevin (1989), Phua (2004), Raiden et al (2004), Rao (2001), Rad (2003), Rockart (1982), Russel and Jaselskis (1997), Sotirou and Wittmer (2001), Shenhar et al (2002), Stewart (2001), Steyn (2002), Soderlund (2004), Skulmoski and Hartman (1999), Thite (1999), Tiong (996), Turner (1994), Thamhain (2004), Turner and Muller (2005), Turner (2004), Verner and Evanco (2005), Verzuh (1999), Walton (1984), Westerveld (2003), Wateridge (1995), White and Fortune (2002), Zipf (1999), and Zika-Viktorsson et al (2003).

Appendix 5: Project success factors (Process) by various authors

Success factors: PROCESS	AUTHORS
Monitoring and control	Avots (1969), Arora (1995), Barnes and Wearne (1993), Belassi and Tukel (1996), Bently and Rafferty (1992), Ceran (1995), Chan et al (2001), Chan et al (2004), Chan (2004), Christian (1993), Cleland (1999), Chua et al (1999), Cooke-Davies (2002), Finch (2003), Forger (2004), Garret (2000), Hartman and Ashrafi (2002), Hartman et al (1991), Iyer and Jha (2005), Jefferies et al (2002), Jiang and Heiser (2004), Kanter and Walsh (2004), Kartam et al (2000), Kendra and Taplin (2004), Kerzner (2000), Longman and Mullins (2004), Magal et al (1988), Milosevic and Patanakul (2005), Munns and Bjeirmi (1996), Nitithamyong and Tan (2007), Nguyen et al (2004), Pate-Cornell and Dillon (2001), Pinto and Slevin (1988), Pinto and Slevin (1989), Rad (2003), Russel and Jaselskis (1997), Shenhar et al (2002), Westerveld (2003), Wateridge (1995), White and Fortune (2002), Zipf (1999), and Zika-Viktorsson et al (2003).
Planning	Avots (1969), Barnes and Wearne (1993), Belassi and Tukel (1996), Bently and Rafferty (1992), Campobasso and Hosking (2004), Ceran (1995), Chan et al (2004), Chan (2004), Christian (1993), Clarke (1999), Garret (2000), Hartman and Ashrafi (2002), Judgev and Muller (2005), Jiang and Heiser (2004), Kanter and Walsh (2004), Kartam et al 2000), Kendra and Taplin (2004), Kerzner (2000), Lidow (1999), Longman and Mullins (2004), Lynch and Cloutier (2003), Milosevic and Patanakul (2005), Munns and Bjeirmi (1996), Nitithamyong and Tan (2007), Nguyen et al (2004), Pinto and Slevin (1989), Shenhar et al (2002), Skulmoski and Hartman (1999), Verzuh (1999), Wateridge (1995), and White and Fortune (2002).
Scheduling	Avots (1969), Arora (1995), Belassi and Tukel (1996), Bently and Rafferty (1992), Ceran (1995), Chan (2004), Christian (1993), Cleland (1999), Chua et al (1999), Clarke (1999), Cooke-Davies (2002), Forger (2004), Garret (2000), Gray (2001), Jefferies et al (2002), Jiang and Heiser (2004), Kanter and Walsh (2004), Kendra and Taplin (2004), Kerzner (2000), Lynch and Cloutier (2003), Morris and Hough (1987), Milosevic and Patanakul (2005), Munns and Bjeirmi (1996), Pinto and Slevin (1988), Pinto and Slevin (1989), Rad (2003), Shenhar et al (2002), Steyn (2002), Verzuh (1999), Westerveld (2003), and White and Fortune (2002).
Quality management	Arora (1995), Ceran (1995), Chan et al (2004), Kerzner (2000), Milosevic and Patanakul (2005), Rad (2003), Shenhar et al (2002), Westerveld (2003), and Zipf (1999).
Risk management	Barnes and Wearne (1993), Chan et al (2001), Chan et al (2001), Chua et al (1999), Cooke-Davies (2002), Czuchry and Yasin (2004), Forger (2004), Garret (2000), Kerzner (2000), Milosevic and Patanakul (2005), Pate-Cornell and Dillon (2001), Phua (2004), Rad (2003), Steyn (2002), Verner and Evanco (2005), Westerveld (2003), and White and Fortune (2002).

Appendix 6: Project success factors (Organization) by various authors

Success Factors: ORGANIZATION	**Authors**
Organization structure	Avots (1969), Appelbaum (2004), Arora (1995), Baccarini (1999), Belassi and Tukel (1996), Chan et al (2001), Chan et al (2004), Cleland (1999), Chua et al (1999), Clarke (1999), Cooke-Davies (2002), Czuchry and Yasin (2004), De Wit (1988), Gray (2001), Hartman and Ashrafi (2002), Hoegl and Gemuenden (2001), Iyer and Jha (2005), Jang and Lee (1998), Judgev and Muller (2005), Jiang and Heiser (2004), Kartam et al (2000), Kendra and Taplin (2004), Kleim and Ludin (1992), Kwak (2002), Longman and Mullins (2004), Lynch and Cloutier (2003), Magal et al (1988), Morris and Hough (1987), Milosevic and Patanakul (2005), Munns and Bjeirmi (1996), Nitithamyong and Tan (2007), Nguyen et al (2004), Pate-Cornell and Dillon (2001), Pinto and Slevin (1988), Pinto and Slevin (1989), Rao (2001), Rad and Levin (2003), Shenhar et al (2002), Stewart (2001), Soderlund (2004), Thite (1999), Turner (1994), Thamhain (2004), Verzuh (1999), Westerveld (2003), White and Fortune (2002), and Zika-Viktorsson et al (2003).
Financial resources	Arora (1995), Belassi and Tukel (1996), Bently and Rafferty (1992), Campobasso and Hosking (2004), Ceran (1995), Chan et al (2001), Chua et al (1999), Forger (2004), Garret (2000), Hartman and Ashrafi (2002), Iyer and Jha (2005), Jefferies et al (2002), Kanter and Walsh (2004), Lidow (1999), Morris and Hough (1987), Milosevic and Patanakul (2005), Nguyen et al (2004), Pate-Cornell and Dillon (2001), Phua (2004), Rad (2003), Russel and Jaselskis (1997), Shenhar et al (2002), Stewart (2001), Steyn (2002), Tiong (996), Verner and Evanco (2005), Westerveld (2003), and White and Fortune (2002).
Policy and strategy	Appelbaum (2004), Baccarini (1999), Barnes and Wearne (1993), Belassi and Tukel (1996), Bently and Rafferty (1992), Campobasso and Hosking (2004), Chan et al (2004), Chan (2004), Christian (1993), Chua et al (1999), Hartman and Ashrafi (2002), Hartman et al (1991), Iyer and Jha (2005), Jang and Lee (1998), Judgev and Muller (2005), Kirby (1996), Kwak (2002), Lidow (1999), Longman and Mullins (2004), Lynch and Cloutier (2003), Morris and Hough (1987), Milosevic and Patanakul (2005), Nicolini (2001), Nguyen et al (2004), Pinto and Slevin (1988), Pinto and Slevin (1989), Phua (2004), Shenhar et al (2002), Soderlund (2004), Thite (1999), Turner (1994), Wateridge (1995), Muller (2003), Thamhain (2004), Verner and Evanco (2005), Verzuh (1999), Westerveld (2003), Wateridge (1995), White and Fortune (2002), Yeo (1995), Zipf (1999), and Zika-Viktorsson et al (2003).

Appendix 6: Project success factors (Organization) by various authors (cont'd)

Success Factors: ORGANIZATION	Authors
Learning organization	Cooke-Davies (2002), Duggan and Blayden (2001), Lidow (1999), Longman and Mullins (2004), Nguyen et al (2004), Pate-Cornell and Dillon (2001), Verner and Evanco (2005), White and Fortune (2002), and Zika-Viktorsson et al (2003).
External Environment	Belassi and Tukel (1996), Chan et al (2004), Chua et al (1999), Iyer and Jha (2005), Judgev and Muller (2005), Kwak (2002), Longman and Mullins (2004), Morris and Hough (1987), Pate-Cornell and Dillon (2001), Pinto and Slevin (1989), Phua (2004), Westerveld (2003), White and Fortune (2002), and Yeo (1995).

Appendix 7: Project success factors (Contract and technical) by various authors

Success Factors: CONTRACT & TECHNICAL	Authors
Contracting	Arora (1995), Barnes and Wearne (1993), Bently and Rafferty (1992), Ceran (1995), Chan et al (2001), Chan et al (2004), Christian (1993), Chua et al (1999), Garret (2000), Jefferies et al (2002), Kanter and Walsh (2004), Kwak (2002), Longman and Mullins (2004), Morris and Hough (1987), Milosevic and Patanakul (2005), Nguyen et al (2004), Pinto and Slevin (1988), Phua (2004), Rad (2003), Rockart (1982), Shenhar et al (2002), Skulmoski and Hartman (1999), and Westerveld (2003).
Contractor	Arora (1995), Bently and Rafferty (1992), Chan et al (2001), Chan et al (2001), Chua et al (1999), Kartam et al (2000), Nguyen et al (2004), Pate-Cornell and Dillon (2001), Phua (2004), and Shenhar et al (2002).
Technical	Appelbaum (2004), Arora (1995), Bently and Rafferty (1992), Chanet al (2001), Cleland (1999), Chua, Kog and Loh (1999), Jiang and Heiser (2004), Kanter and Walsh (2004), Kwak (2002), Longman and Mullins (2004), Morris and Hough (1987), Milosevic and Patanakul (2005), Pate-Cornell and Dillon (2001), Prabhakar (2005), Pinto and Slevin (1988), Pinto and Slevin (1989), Phua (2004), Shenhar et al (2002), Skulmoski and Hartman (1999), Tiong (996), and Yeo (1995).
Innovation	Chan (2004), Czuchry and Yasin (2003), Hartman and Ashrafi (2002), Morris and Hough (1987), Nguyen et al (2004), Pate-Cornell and Dillon (2001), Phua (2004), Stewart (2001), Tiong (996), White and Fortune (2002), and Zika-Viktorsson et al (2003).

Appendix 8: Ranking of project success criteria by other authors

AUTHORS	Stakeholders' appreciation	Time	Cost	Quality
Hartman et al (1998)	1	2	3	3
White and Fortune (2002)	1	4	3	2
Collins and Baccarini (2004)	1	2	2	2
Wang and Huang (2005)	1	3	4	2
Asif (2004)		1	2	3
Gao et al (2002)	3	2	1	4
Yang et al (1997)	4	2	3	1
Wateridge (1995)	No consensus			
Chua et al (1999)	No consensus			

Appendix 9: Ranking of critical success factors by other authors

	CRITICAL SUCCESS FACTORS	Pinto 1988	Belassi 1996 –IT	Belassi 1996	White 2002	Shenhar 2002 – LT	Shenhar 2002 – HT	Hartman 2002	Asif 2003	Kanter 2004	Nguyen et al 2004	Chan 2004	Iyer 2005
1	Availability of resources		3	3							5		
2	Clear Project mission	1			1			4	1				
3	Client consultation	2	1	5	5		5	2				3	
4	Client's competence												5
5	Client acceptance	4						1	4				
6	Communication							3					
7	Commitment										4		4
8	Contractor					1						4	
9	Documentation						4		5				
10	Financial		4	4	3	2					2		
11	Monitoring and control								3	5			3
12	Nature of project											5	
13	Project manager		5	2		5				3	1		1
14	Project definition						1			1			
15	Team and leadership									4	3	2	
16	Planning								2				
17	Project management											1	
18	Quality management					4							
19	Schedule	5			4		2			2			
20	Top management support	3	2	1	2			5					2
21	Technical & Design					3	3						

Legend with reference to Appendix 9:

Pinto	Pinto and Prescott (1988)
Belassi	Belassi and Tukel (1996) for IT projects only
Belassi	Belassi and Tukel (1996)
White	White and Fortune (2002)
Shenhar et al	Shenhar et al (2002) – for low technology projects
Shenhar et al	Shenhar et al (2002) – for high technology projects
Hartman	Hartman and Ashrafi (2002)
Asif	Asif (2003)
Kanter	Kanter and Walsh (2004)
Nguyen et al	Nguyen et al (2004)
Chan	Chan (2004)
Iyer	Iyer and Jha (2005)

Appendix 10: Methods chosen by other authors

AUTHOR	DATA COLLECTION	DATA ANALYSIS	TYPE OF INDUSTRY	RESPONSES	PROFILE
Pinto and Prescott (1988)	Questionnaire survey 7-point Likert scale (degree of agreement)	Stepwise regression and Ridge regression	Various industries	408 responses (69%)	Client, Consultant, Contractor
Wateridge (1995)	Structured Interview	Frequency of mention	Various industries	100 projects	Project managers. Users, sponsors
Belassi and Tukel (1996)	Questionnaire survey Ranking	Descriptive statistics and Frequency of mention	Various industries	91 responses	Consultants
Yang et al (1997)	Questionaire survey and interview	Quantitative ranking	Various industries	38 enterprises	Project manager Director
Hartman et al (1998)	Structured Interview	Mean score and quantitative ranking	Information technology	42 interviews	Consultant
Chua et al (1999)	Questionnaire survey Hierarchical model, nine-point scale	Analytical hierarchy process and Pairwise comparison	Construction (Singapore)	20 experts with 20 years experience	Client, Consultant, Contractor, Statutory Body
Gao et al (2002)	Questionnaire survey and interview	Quantitative ranking	Construction	36 responses	Manager Engineer
Shenhar et al (2002)	Questionnaire survey	Canonical correlation analysis	Construction (Israel)	127 projects	Project manager
White and Fortune (2002)	Pilot study and Questionnaire survey, multiple choice	Frequency of mention	Various industries	236 responses (23.72%)	Project manager In Public And Private Sectors
Hartman and Ashrafi (2002)	Questionnaire survey 5-point scale (degree of importance)	Descriptive statistics, Relative importance index	Entertainment	36 responses	Client, Consultant, Contractor

Appendix 10: Methods chosen by other authors (cont'd)

AUTHOR	DATA COLLECTION	DATA ANALYSIS	TYPE OF INDUSTRY	RESPONSES	PROFILE
Asif (2003)	Interview	Analytical hierarchy , Spearman correlation, Kendall's concordance	Construction (Saudi Arabia)	60 experts interviewed	Client, Consultant, Contractor
Chan et al (2004)	Pilot study and Questionnaire survey 5-point Likert scale (degree of agreement)	Factor analysis and Multiple regression	Construction (Hong Kong)	78 response (30%)	Client, Consultant, Contractor
Nguyen et al (2004)	Pilot study and Questionnaire survey 5-point scale (degree of significance)	Descriptive statistics, Spearman correlation and Factor analysis	Construction (Vietnam)	109 response (25%)	Client, Consultant , Contractor
Chan (2004)	Questionnaire survey and face-to-face interview	Factor analysis and Stepwise multiple regression analysis	Construction (Hong Kong)	52 response	
Kanter and Walsh (2004)	Questionnaire and Workshop 5-point scale (degree of agreement)	Quantitative ranking	Information technology	80 project managers	Consultant
Collins and Baccarini (2004)	Questionnaire survey mixed structured & open-ended	Descriptive statistics and Frequency analysis	Various industries	150 response (18%)	Client, Consultant, Contractor, Government
Iyer and Jha (2005)	Pilot study and Questionnaire survey 5-point ranking scale	Descriptive statistics	Construction (India)	112 response (25%)	Client, Consultant, Contractor
Wang and Huang (2005)	Pilot study and Questionnaire survey 5-point scale	Pearson correlation and Descriptive statistics	Construction (China)	245 response (61.3%)	Supervising Engineers

Appendix 11: Exploratory study

Discussions conducted with the following industry players and university lecturers:

1. Ar Khalid Ahmad, Principal of Khalid Ahmad Architects.
2. Tan Sri Dato' Ir Jamilus Hussein, Chairman of Construction Industry Development Board Malaysia and Chief Executive Office of KLIA Premier Holdings Sdn Bhd.
3. Dato' Sr Abdul Rahman Abdullah, former Chairman of Construction Industry Development Board Malaysia.
4. Dato' Seri Sr Hj Md Isahak Md Yusuf, Chairman of Pakatan International Md Isahak dan Rakan-Rakan Sdn Bhd.
5. Dato' Sr Abdull Manaf Hashim, Director of Contract and Quantity Surveying Branch, PWD Malaysia, and President of Board of Quantity Surveyors Malaysia.
6. Dato' Ar Nur Haizi Abdul Hai, Director of Architect Branch, PWD Malaysia, and President of Board of Architects Malaysia.
7. Sr Chua Siow Leng, Executive Director (retired) of WCT Berhad.
8. Sr Ong See Lian, Partner of Juru Ukur Bahan Malaysia and Managing Director of DLS Management (M) Sdn Bhd.
9. Sr Roznita Othman, Senior officer, PWD Malaysia.
10. Sr Ratna Mahyuddin, Deputy Director (Contract), DID Malaysia.
11. Sariah Abdul Karib, Senior General Manager, Construction Industry Development Board Malaysia.
12. Sr Noridah Shafei, General Manager, Construction Industry Development Board Malaysia.
13. Assoc. Professor Sr Hasmawati Harun of University Technology Mara.
14. Assoc. Professor Sr Dr Maizon Hashim of University Technology Malaysia.
15. Assoc. Prof Sr Fadhlin Abdullah of University Technology Malaysia.

Appendix 12: Questionnaire

1. This questionnaire is intended for academic purpose. It is hoped that respondent will provide the response based on experience, knowledge and involvement in the implementation of projects.
2. Name and identity will not be revealed without the prior agreement of the respondent.
3. The questionnaire is divided into 7 Sections as follows:

   Section A: Profile of Respondent
   Section B: Measurement on Importance of Project Success Criteria
   Section C: Measurement on Agreement on Project Success Criteria
   Section D: Measurement on Importance of Success Factors for various Criteria
   Section E: Measurement on Importance of Components of Success Factors
   Section F: Measurement on Importance of Elements of Success Factors
   Section G: Comments and views

4. The questionnaire is structured using the following scale as a basis of evaluation:

Scale on Importance	1 =	Least important	*Scale on Agreement*	1 =	Totally Disagree
	2 =	Quite Important		2 =	Disagree
	3 =	Important		3 =	Neutral
	4 =	Very Important		4 =	Agree
	5 =	Critically Important		5 =	Totally Agree

5. Respondent is requested to answer all questions. However, any box that is not marked or left blank is assumed to mean that the respondent does not give emphasis or has not encountered or has no information of such issue in the implementation of the project.

SECTION A: PROFILE OF RESPONDENT

1. *Name of Respondent :* ______________________________

2. *Years of Experience in implementation of projects*

   ☐ Less than 5 years
   ☐ 6 – 10 years
   ☐ 10 – 15 years
   ☐ 15 – 20 years
   ☐ More than 20 years – please specify ______________________________

3. *Your qualification:*

   ☐ Administrator
   ☐ Quantity Surveyor
   ☐ Architect
   ☐ Engineer
   ☐ Semi-professional
   ☐ Others: ______________________________

4. *Business of your organisation:*

   ☐ Government Agency
   ☐ Statutory Body
   ☐ Project Management Consultant
   ☐ Developer
   ☐ Contractor
   ☐ Others: ______________________________

5. *Project(s) successfully completed AND name of client(s)*

   ☐ Education projects ______________________________
   ☐ Health projects ______________________________

- [ ] Housing projects
- [ ] Security projects
- [ ] Others

6. *In what capacity were you within the Project Team?*

- [ ] Project Coordinator
- [ ] Project Director
- [ ] Project Manager
- [ ] Others: ____________

SECTION B: MEASUREMENT ON IMPORTANCE OF PROJECT SUCCESS CRITERIA

PART 1.0: PROJECT COMPLETION

	*What is the level of importance of the following success criteria? **Please rank**:*	Importance
7	Project complete within the specified Time.	1 2 3 4 5
8	Project complete within the approved Cost.	1 2 3 4 5
9	Project complete as the required Quality.	1 2 3 4 5
10	Project complete with Stakeholders' Appreciation.	1 2 3 4 5
11	Others – please specify:	1 2 3 4 5

PART 2.0: TIME

	Your response to the following issue regarding success criteria:	Importance
12	Complete on or before date of completion.	1 2 3 4 5
13	Delays rectified.	1 2 3 4 5
14	Minimum extension of time.	1 2 3 4 5
15	Others:	1 2 3 4 5

PART 3.0: COST

	Your response to the following issue regarding success criteria:	Importance
16	Complete as budgeted.	1 2 3 4 5
17	Minimum variations.	1 2 3 4 5
18	Minimum claims.	1 2 3 4 5
19	Others:	1 2 3 4 5

PART 4.0: QUALITY

	Your response to the following issue regarding success criteria:	Importance
20	Complete as the required specification, drawings etc.	1 2 3 4 5
21	Good workmanship and minimum defects.	1 2 3 4 5
22	Minimum scope change.	1 2 3 4 5
23	Others:	1 2 3 4 5

PART 5.0: STAKEHOLDERS' APPRECIATION

	Your response to the following issue regarding success criteria:	Importance
24	Stakeholders' satisfaction.	1 2 3 4 5
25	Meet project objectives and requirements.	1 2 3 4 5
26	Yield profit & business or other benefits.	1 2 3 4 5
27	Others:	1 2 3 4 5

SECTION C: MEASUREMENT ON AGREEMENT ON PROJECT SUCCESS CRITERIA

PART 1.0: PROJECT COMPLETION WITHIN TIME

	Your response to the following issue regarding success criteria:	Agreement
		1 2 3 4 5
28	Time is more important than Cost.	1 2 3 4 5
29	Time is more important than Quality.	1 2 3 4 5
30	Time is more important than Stakeholders' Appreciation.	1 2 3 4 5

PART 2.0: PROJECT COMPLETION WITHIN APPROVED COST

	Your response to the following issue regarding success criteria:	Agreement
31	Cost is more important than Time.	1 2 3 4 5
32	Cost is more important than Quality.	1 2 3 4 5
33	Cost is more important than Stakeholders' Appreciation.	1 2 3 4 5

PART 3.0: PROJECT COMPLETION TO THE REQUIRED QUALITY

	Your response to the following issue regarding success criteria:	Agreement
34	Quality is more important than Time.	1 2 3 4 5
35	Quality is more important than Cost.	1 2 3 4 5
36	Quality is more important than Stakeholders' Appreciation.	1 2 3 4 5

PART 4.0: PROJECT COMPLETION WITH STAKEHOLDERS' APPRECIATION

	Your response to the following issue regarding success criteria:	Agreement
37	Stakeholders' Appreciation is more important than Time.	1 2 3 4 5
38	Stakeholders' Appreciation is more important than Cost.	1 2 3 4 5
39	Stakeholders' Appreciation is more important than Quality.	1 2 3 4 5

SECTION D: MEASUREMENT ON IMPORTANCE OF SUCCESS FACTORS FOR DIFFERENT CRITERIA

PART 1.0: TIME

	*What is the level of importance of the following factors in ensuring work is completed within Time? **Please rank:***	Importance
40	Human Management.	1 2 3 4 5
41	Process.	1 2 3 4 5
42	Organization.	1 2 3 4 5
43	Contractual & Technical.	1 2 3 4 5
44	Others:	1 2 3 4 5

PART 2.0: COST

	*What is the level of importance of the following factors in ensuring work is completed within Cost? **Please rank:***	Importance
45	Human Management.	1 2 3 4 5
46	Process.	1 2 3 4 5
47	Organization.	1 2 3 4 5
48	Contractual & Technical.	1 2 3 4 5
49	Others:	1 2 3 4 5

PART 3.0: QUALITY

	What is the level of importance of the following factors in ensuring work is completed as the required Quality? **Please rank :**	Importance
50	Human Management.	1 2 3 4 5
51	Process.	1 2 3 4 5
52	Organization.	1 2 3 4 5
53	Contractual & Technical.	1 2 3 4 5
54	Others:	1 2 3 4 5

PART 4.0: STAKEHOLDERS' APPRECIATION

	What is the level of importance of the following factors in ensuring work is completed with Client's Appreciation? **Please rank :**	Importance
55	Human Management.	1 2 3 4 5
56	Process.	1 2 3 4 5
57	Organization.	1 2 3 4 5
58	Contractual & Technical.	1 2 3 4 5
59	Others:	1 2 3 4 5

SECTION E: MEASUREMENT ON IMPORTANCE OF COMPONENTS OF SUCCESS FACTORS

PART 1.0: HUMAN MANAGEMENT

	What is the level of importance of the following components? **Please rank:**	Importance
60	Team and Leadership.	1 2 3 4 5
61	Project Manager.	1 2 3 4 5
62	Communication.	1 2 3 4 5
63	Stakeholder Management.	1 2 3 4 5
64	Others:	1 2 3 4 5

PART 2.0: PROCESS

	What is the level of importance of the following components? **Please rank:**	Importance
65	Planning.	1 2 3 4 5
66	Scheduling.	1 2 3 4 5
67	Control & Monitoring.	1 2 3 4 5
68	Quality Management.	1 2 3 4 5
69	Risk Management.	1 2 3 4 5
70	Others:	1 2 3 4 5

PART 3.0: ORGANIZATION

	What is the level of importance of the following components? **Please rank:**	Importance
71	Organization structure.	1 2 3 4 5
72	Financial resources.	1 2 3 4 5
73	Policy & Strategy.	1 2 3 4 5
74	Learning organization.	1 2 3 4 5
75	External Environment.	1 2 3 4 5
76	Others:	1 2 3 4 5

PART 4.0: CONTRACTUAL & TECHNICAL

	*What is the level of importance of the following components? **Please rank**:*	Importance
77	Procurement & Contract.	1 2 3 4 5
78	Contractor.	1 2 3 4 5
79	Technical.	1 2 3 4 5
80	Innovation.	1 2 3 4 5
81	Others:	1 2 3 4 5

SECTION F: MEASUREMENT ON IMPORTANCE OF ELEMENTS OF SUCCESS FACTORS

PART 1.0 HUMAN MANAGEMENT

	What is the level of importance of the following elements?	Importance
82	Cooperation within the project team.	1 2 3 4 5
83	Capable leadership.	1 2 3 4 5
84	Commitment of project team.	1 2 3 4 5
85	Project manager's competence.	1 2 3 4 5
86	Project manager's experience.	1 2 3 4 5
87	Project manager's integrity.	1 2 3 4 5
88	Ensure stakeholders are aware of the status and problems of project.	1 2 3 4 5
89	Establish the line of communication, information channel and procedures.	1 2 3 4 5
90	Timely and valuable information/decision communicated.	1 2 3 4 5
91	Address stakeholders' requirements.	1 2 3 4 5
92	Stakeholders consultation and participation.	1 2 3 4 5
93	Manage the bureaucracy in getting all the necessary approvals.	1 2 3 4 5
94	Others:	1 2 3 4 5

PART 2.0: PROCESS

	What is the level of importance of the following elements?	Importance
95	Comprehensive and precise plan.	1 2 3 4 5
96	Taken into consideration limitations and constraints.	1 2 3 4 5
97	Review of Plan when actual differs from plan.	1 2 3 4 5
98	Program of work is realistic, clear and precise.	1 2 3 4 5
99	Reasonable duration and completion period.	1 2 3 4 5
100	Review of the program of work in the event of delay.	1 2 3 4 5
101	Set up control mechanism and procedures.	1 2 3 4 5
102	Monitoring & feedback through meetings, reporting and review.	1 2 3 4 5
103	Document Control Management.	1 2 3 4 5
104	Quality Management System.	1 2 3 4 5
105	Quality plan & Quality control.	1 2 3 4 5
106	Safety, Health and Environment Management.	1 2 3 4 5
107	Risk Management System.	1 2 3 4 5
108	Analyse and manage the risks.	1 2 3 4 5
109	Allocation of responsibility on managing the risk.	1 2 3 4 5
110	Others:	1 2 3 4 5

PART 3.0: ORGANIZATION

	What is the level of importance of the following elements?	Importance				
111	Clear authority delegation and responsibilities.	1	2	3	4	5
112	Functional managers' support.	1	2	3	4	5
113	Top management support and Project Champion.	1	2	3	4	5
114	Prompt payment.	1	2	3	4	5
115	Cost planning and Cost control.	1	2	3	4	5
116	Sufficient financial resources.	1	2	3	4	5
117	Formulation of project strategy.	1	2	3	4	5
118	Clear, understandable and achievable goals and objectives.	1	2	3	4	5
119	Factors related to Project namely complexity, size, uniqueness etc.	1	2	3	4	5
120	Capture lesson learnt for the benefit of future projects.	1	2	3	4	5
121	Ensure mistakes of past projects are not repeated.	1	2	3	4	5
122	Ensure what were done correctly are repeated.	1	2	3	4	5
123	Political environment.	1	2	3	4	5
124	Economic environment.	1	2	3	4	5
125	Social and Community involvement.	1	2	3	4	5
126	Others:	1	2	3	4	5

PART 4.0: CONTRACTUAL AND TECHNICAL

	What is the level of importance of the following elements?	Importance				
127	Procurement strategy and contract documentation.	1	2	3	4	5
128	Contract administration.	1	2	3	4	5
129	Resolution of contractual disputes.	1	2	3	4	5
130	Contractor's attitude.	1	2	3	4	5
131	Contractor's capability.	1	2	3	4	5
132	Contractor's key personnel.	1	2	3	4	5
133	Coordination between consultants.	1	2	3	4	5
134	Delivery of required deliverables.	1	2	3	4	5
135	Resolution of technical issues such as interfacing works, technical disputes, etc	1	2	3	4	5
136	Technical innovation.	1	2	3	4	5
137	Innovation in methods and procedures.	1	2	3	4	5
138	Commitment and readiness on innovation.	1	2	3	4	5
139	Others:	1	2	3	4	5

SECTION G: COMMENTS & VIEWS:

1 In your opinion what is the most important criteria to measure the success of a project AND why?

2 What are the detrimental factors that would hinder successful implementation and completion of a project AND why?

3 Does the importance of the critical success factors differ in relation to the size and complexity of a project AND why?

4. In a project life cycle i.e. inception, design, tender, construction and close-out, when do you need to put in place these critical success factors AND why?

Human Management					
Process					
Organization					
Contract & Technical					
	INCEPTION	DESIGN	TENDER	CONSTRUCTION	HANDOVER & CLOSE-OUT

Appendix 13: Validation on the findings of the study

The findings of this study are tested by conducting a simple questionnaire to several client organizations. This includes four (4) private sector client organizations and four (4) government agencies that implements projects using project management teams. Although the study is confined to government projects, the validation exercise is extended to other client organizations as these organizations have requested to be included. A total of 50 project managers participated in the validation of this study. The questionnaires require the respondents to agree or disagree with the findings namely the significant success criteria, success factors and the correlation of these criteria and factors. The result of the validation exercise generally seems to support the main findings of the study.

Firstly, all the respondents (100%) agree that to determine the success or failure of a project, the measurements are the criteria of '*Stakeholders' appreciation*', '*Quality*', '*Time*' and '*Cost*'. All the respondents also agree on the explaination of the criteria as described in the study. Similarly, on the ranking of these success criteria, all the respondents (100%) agree that '*Stakeholders' appreciation*' takes precedence over the criteria of '*Quality*', '*Time*' and '*Cost*'.

The next set of questions is regarding success factors. All the respondents (100%) agree the ranking of the critical success factors as follows: '*Human management*', '*Process*', '*Contract and technical*', and '*Organization*'. Lastly, majority of the respondents agree on the ranking of the factors within the factor groups. For the success factor group of

'*Human management'* all the respondents (100%) agree that the critical success factor is team and leadership; for '*Process'* 49 respondents (98%) agree that the critical success factor is monitoring and control; for '*Contract and technical'* all the respondents (100%) agree that the critical success factor is contracting; and for '*Organization'* 48 respondents (96%) agree that the critical success factor is organizational structure.

The last set of questions is regarding the correlation of success criteria and success factors. 48 respondents (96%) agree that to achieve each of the success criterion, the ranking of the success factors is similar. This means that the critical success factors to achieve any of the success criteria of '*Stakeholders' appreciation'*, *'Quality'*, *'Time'* and '*Cost'* are similarly ranked in order of '*Human management'*, *'Process'*, *'Contract and technical'*, and '*Organization'*.