THE CONTRIBUTION OF KNOWLEDGE MANAGEMENT TO PROJECT MANAGEMENT PERFORMANCE IN ENGINEERING PROJECT-BASED ORGANISATIONS

NEE TECK SOON

MASTER OF BUSINESS ADMINISTRATION

UNIVERSITI TUNKU ABDUL RAHMAN

FACULTY OF ACCOUNTANCY AND MANAGEMENT

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Nee Teck Soon

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By

Nee Teck Soon

This research project is supervised by

Dr Hen Kai Wah
Assistant Professor
Department of International Business
Faculty of Accountancy and Management

DECLARATION

I hereby declare that:

(1) This Research Project is the end result of my own work and that due acknowledgement has been given in the references to all sources of information be they printed, electronic, or personal.

(2) No portion of this research project has been submitted in support of any application for any other degree or qualification of this or any other university, or other institutes of learning.

(3) The word count of this research report is 18364.

Name of Student: Nee Teck Soon

Student ID: 11UKM05998

Signature: _____

Date: 10 Dec 2015

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ABSTRACT

This research studies the relationship between knowledge of project-based and project management success criteria. Hence, the conceptual framework derives from three previous research models. These combination of theoretical models study on the contribution of knowledge contribution to project management performance in engineering project-based organisations. This research is tested on survey data conducted among the project team members from engineering project-based organisations in Malaysia. Findings show that knowledge of organisational solution and knowledge of business value need to be identified and shared among the staffs. Both knowledge of organisational solution and knowledge of business value are significantly positive relationship with scope of work control, cost control, and project schedule control. Besides that, knowledge of technical solution and knowledge of business value statistical significantly predicted scope of work control, $F(3, 36) = 11.774$. The limitation of this research reflects on the statistical results in correlation bivariate test. Most of the relationships are at the weak and medium strength level.

CHAPTER 1

INTRODUCTION

1.1 Overview

Project-based organisations provide unique product and service. Project management represent as a knowledge, skills, techniques and tools to project works to achieve project necessity among project-based organisations (Lierni, 2004). Most of the project management literature highlighted that understanding the particular governance challenges are an important focus for more rigorous research on management of project (Ahern, Leavy, & Byrne, 2014). Knowledge has been categorised as a critical driving forces for business success. Therefore, project-based organisations are more focusing on knowledge intensive and getting more appreciation on knowledge value. Knowledge has been treated as a kind of tangible resources and many organisations are emphasising on knowledge management to gain competitiveness and sustainability. Knowledge management become the basic success requirement for organisations regardless of the size of business and geographical locations (Wong, 2005).

The practice of knowledge management in project-based organisations usually confront different challenges. These challenges exist because of the nature of projects that work on long life cycle and the project teams usually form from different companies with different knowledge and experience for a short period of time (Hashim, Talib, & Alamen, 2014). Thus, project-based organisations require special knowledge sharing to capture knowledge from different individuals and convert it to explicit knowledge (Hashim et al., 2014).

This paper is focusing on the contribution of knowledge to project management performance in engineering project-based organisations. A survey is conducted to find out the impact of knowledge management onto project management. This survey includes finding factors which causes failure in project management.

1.2 Malaysian Engineering Industry Background

In year 1957, Malaysia gained its independence. Started from independence, the Malaysian Engineering industry has performed as catalyst in the economic development of the country (Wong, 2012). The Malaysian engineers improved in term of technology transfers from foreign engineering firms through partnership in the sixties and seventies (Wong, 2012). This has allowed the engineers to improve their expertise and skills, so that world-class standards can be achieved and to commence a multiplicity of giant projects (Accenture, 2010; IEM, 2001; Judin, 2001). Some remarkable projects were the Kuala Lumpur International Airport, North-South Highway, Light Rail Transit Systems, Penang Bridge and Petronas Twin Towers (Hamdan, 1999).

In Malaysia, the engineering industry is observed as one of the key contributors towards Malaysia economy (Ngai, Drew, Lo, & Skitmore, 2002) about seven to ten percent of the gross domestic product (GDP) value (Winch, 1995). Additionally, engineering project usually played a main role in the safety, health and environmental parts of the society (Bayliss, Cheung, Suen, & Wong, 2004). The Malaysian engineering industry is highly controlled and protected under the Registration of Engineers Act 1967 (REA). It states that only qualified Malaysian professional engineers (PEs) are allowed to endorse and submit construction or project plans to regulatory authorities (Chiam, 2009).

The previous studies on the export performance of Malaysian engineering firm shows that not many Malaysian engineering firms are providing services to the foreign markets (Looi, 2003). This could be due to the nature of Malaysia engineering firms which choose

to operate within their comfort zone (local market) rather than venturing into the unfamiliar international markets (Wong, 2000; IEM, 2001).

1.3 Project Management Background in Malaysia

Most of the project personnel have learnt both explicit and tacit knowledge through experiential learning, with majority of the project personnel holding an engineering or engineering related first degree (Crawford & Gaynor, 1999; PMI, 1999), but very few are holding the project management degree (Turner & Huemann, 2000). This is supported by an international cross industry survey, which found that less than 15% of project personnel currently holding project management certification or registered with accredited body (Crawford & Gaynor, 1999). Therefore, experiential learning is the only method of improving competency of the project personnel, and so if project-based organisations are not emphasising a thoughtful and maintained attempt to support the experiential learning of their project personnel, so that the outcomes can be achieved (Turner & Huemann, 2000).

Professional associations have tried to arrange the progression of project management competence improvement using standards and associated certification programs. Few standards have been used as guidelines in the project management practice; to supply guidelines for those involved in managing projects; to define common descriptions of terms and processes; and act as a foundation for valuation of project management competence for professional certification or registration. These include (Turner & Huemann, 2000):

- "A Guide to the Project Management Body of Knowledge
- ICB: International Project Management Association (IPMA)
- Competence Baseline Australian National Competency Standards for Project Management (AIPM)
- PRINCE 2"

All these standards are focusing on generic project management knowledge, practices and skills, but are not comprehensive enough to address technical solution, organisation solution and business values.

1.4 Problem Statement

A project is measured as failure when it has not produced what was expected from the requirements (Dalcher, 2012; Standing, Guilfoyle, Lin, & Love, 2006). According to Standish Group's Chaos Report (2009), there are only 32% of all surveyed projects are categorised as successful and complied on schedule, on project budget, with the qualities and proper functionality aspect (Frank, Sadeh, & Ashkenasi, 2011). In other words, a successful project has to be a project that is being delivered on time with the right quality and budget which in turn benefits the business case.

When a wrong project is delivered, it can be identified as a failure even it had been delivered within budget, on time, and pass the standard quality (Storey & Barnett, 2000). However, if a project has not been delivered according to the client's requirement, it will seriously affect the organisational image. Therefore, the business requirement is importance to start up a project (Storey & Barnett, 2000). If a project cannot be completed accordingly, it will result in a chain of effect, which includes project's deadlines, budgets and expectations (Gill, 2008).

Project management skills can be obtained through tacit knowledge, which have been studied through experiential knowledge in project management based on analysis of failure and causes (Ioi, Ono, Ishii, & Kato, 2012). This has make practical knowledge transfer in project management possible (Ioi et al., 2012). Structure, culture, processes and strategy are the factors of the effectiveness of organisational knowledge transfer (Rhodes, Hung, Lok, Lien, & Wu, 2008). Besides that, project management team is a usually a temporary team, who may share their experiences, knowledge and perception

on works (Yeong & Lim, 2010). Therefore, project manager must create a working ambient in where knowledge can be identified or created, shared and practiced in project lifecycle in order to deliver a desired product to client. For these reasons, global knowledge management is becoming a reality and sustainable value for an organisation (Yeong & Lim, 2010). It is the only way to make the organisation success and grow in the future. This indicated that project management personnel have not fully attained and kept knowledge learned from previous projects to improve success rate on current and future projects (Yeong & Lim, 2010). However, the previous researches do not have much emphasis on the relationship between knowledge management and project management in engineering project management organisations. It is necessary to find out the importance of knowledge management in order to deliver a successful project and improve company profit (Lierni, 2004). Besides that, there are very few studies in knowledge management literature that measure the criteria of a successful project management, especially in project-based engineering organisations. In fact, there is a crucial need of forming knowledge management development within organisation in Malaysia and there is limited research in knowledge management in Malaysian organisations (Chong, 2006).

This research project will show the contribution of knowledge management to project management in engineering project-based organisations. This research will be looking at three types of project knowledge and their influence on project management in a project based organisation. Scope of work, quality work, project budget, and project schedule will be studied as the measurement of a successful project management. According to Todorović, Petrović, Mihić, Obradović, & Bushuyev (2015), knowledge management in project-based organisations is an insufficiently studied area in project management. In the past, the researches focused on individual case, specific project types and case studies on industries (Todorović et al., 2015). Over the last couple of years, researchers started to study the influence of knowledge management on project performance (Todorović et al., 2015).

1.5 Research Rationale

In fact, knowledge workers teams can contribute accumulated knowledge to project team (Zhao, Zuo, & Deng, 2015). Project management knowledge transfer bring a position effect on project outcome, in order to improve project execution process and recover project efficiency and service quality (Zhao et al., 2015). However, project management knowledge transfer is not always positive (Newell & Edelman, 2008). Project-based organisations find difficult to store knowledge learned and document it (Newell & Edelman, 2008). The problems existed on project management knowledge transfer give negative feedback on the organisation development and project management capabilities, affecting organisation performance in the long term (Zhao et al., 2015). Therefore, method of project knowledge management challenges to project-based organisations, managing knowledge and transfer on project management is a complex challenge need to be studied.

1.6 Research Significance

One of the criteria of a successful organisation is that it is able to turn ideas into action and recognise effective knowledge transfer as essential to their competitive advantage (Profession®, 2015). Knowledge transfer is implanted in the culture of the effective organisations because they are knowingly more likely to appreciate the knowledge transfer progressions that are in place (Profession®, 2015).

The unpredictable condition of projects create major challenges for project leaders and project-based organisations (Ajmal, 2009). The findings of this research will provide the up to-date information towards the current situations on the Malaysian engineering industry. Perception of engineers or engineering stakeholders on knowledge management will be examined in future research.

Besides that, this research may implicate for project-based organisation in order to handle knowledge management. There are three knowledge fields to be studied, the result of research can be the focus of the project-based organisation in order to implement knowledge management within the organisation. Based on the research report, organisation is able to focus the most important direction of knowledge to give training to their staffs. Besides that, the execution of knowledge management can be effectively improved.

1.7 Research Objective (RO)

In link with the problem statement this study enclosed the following objectives:

a) To verify the contribution of knowledge management towards project management.
b) To verity the relationship of project-based knowledge categories to success project management criteria.
c) To identify factors of implementation knowledge management in success project.
d) To identify difficulties of execution knowledge management in engineering companies.

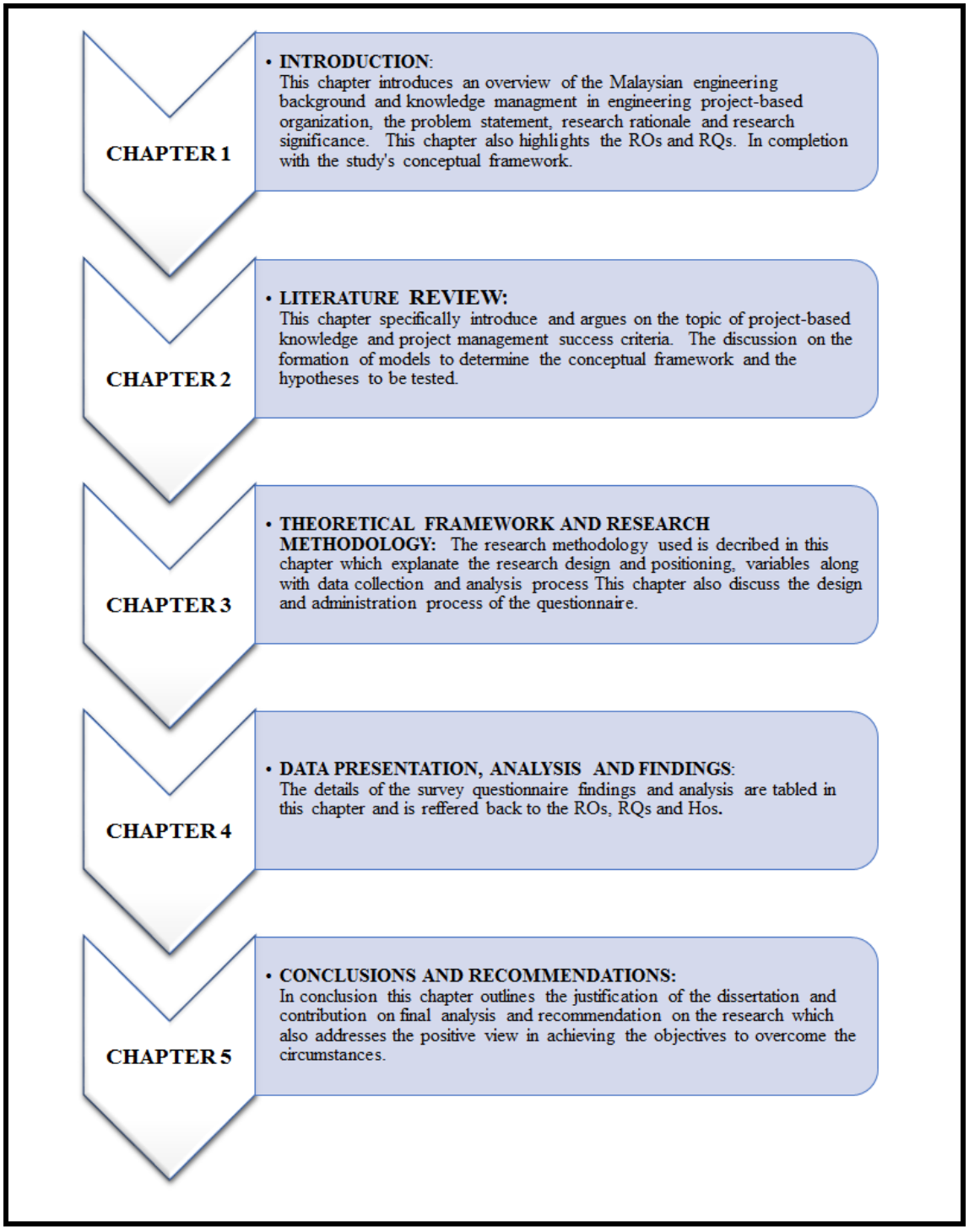
1.8 Research Questions (RQ)

This research will be examined the following questions:

a) What are the contribution of knowledge management towards project management?
b) How to relate project-based knowledge categories to success project management criteria?
c) What are the factors of implementation knowledge management in success project?
d) What are the difficulties of execution knowledge management in engineering companies?

1.9 Organisation of Study

Figure 1: Organisational of Study



1.10 Summary

Four research questions will be explored in this study. These research questions can be employed to explain on research objectives of the research. There are three project-based knowledge to be studied in order to relate to project management success criteria. Conclusively, this conceptual framework will be able to contribute to the project-based organisations. The reason of choosing these three field of knowledge will be further explained in the chapter two.

Chapter 2

LITERATURE REVIEW

Project failure create a damaging image to the project-based organisations (Sage, Dainty, & Brookes, 2014). There are three reasons that lead to failures in engineering project, such as the instability of the market condition, the complication of organisation, and the failure in controlling and management (Geppa, Hellmuth, Schaffler, & Vollmar, 2014). Lee & Choi (2003), Quigley, Locke, & Bartol (2007), Kotnour (2000), and Barber & Warn (2005). These confirmed that there are positive influence of knowledge management on project performance.

Knowledge management has been acknowledged as a key factor for project success (Sokhanvar, Matthews, & Yarlagadda, 2014). The high mobility among project team members caused several issues, such as reparative activities, leaking of project knowledge and double works, become a major challenges in project-based organisations (Sokhanvar et al., 2014). Most of the researches identified the challenges of knowledge management in project environment are as below:

- "The lack of routines and other appropriate learning mechanisms, as well as the availability of the previously learned lessons and reports from the previous projects.
- Documenting project operations, i.e. recording their organisational processes, rarely fail to fully reflect the course of procedures and activities, which is why their purposefulness is doubtful.

- The lack of efficient and effective forecasts, insufficient communication and exchange of information, inadequate use of the previous experience and lessons learned.
- The uniqueness of projects and their long life cycle; therefore, a long time interval passes before lessons are retrieved, while projects' temporary nature requires new team meetings for each project.
- Action-and-task orientation of project-intensive organisational structure (i.e. temporary organisation), where project team members are not geared for learning. Individuals become more able and experienced; nevertheless, there is often no mechanism or motivation for that knowledge to be shared within the company.
- A contradiction between short-term goals of projects and long-term goals of organisational learning, where knowledge management depends on the degree of projectisation of the company, i.e. on the level of a firm's project maturity" (Todorović et al., 2015).

The literature review consists of two portions, first part covered the background of theoretical framework in project-based knowledge and project management success criteria. Secondly, discussion on the factors and difficulties of implementation of knowledge management to the project management success. The background information on project-based knowledge and project management criteria assists the understanding of the correlation of dependent variables and independent variables of the research. Background information on literature review provided primary input to start up a conceptual framework and the breakdown of project-based knowledge that may influence project management success. Besides that, the project management success analysis process contains the process of gathering necessary information to evaluate project performance, this identified that project management success has to be connected with knowledge management in project-based organisations in order to increase the knowledge data base. In summary, the preliminary study is used to gain a useful understanding of both knowledge management and project management. Based on the insight gained from literature review helped in casting the conceptual framework. The ultimate goal of the study is to justify the correlation of dependent variables and

independent variables on the conceptual framework and provide solution or proposed solution to research questions mentioned in Chapter 1.

2.1 Knowledge Management

Knowledge management research started in 1970s and the impact of the research contributed to method of knowledge producing, knowledge used within organisations (Lierni, 2004). The development of information technology assisted in technological base for managing knowledge, especially in United States (Lierni, 2004). In the mid-1990s, the internet development improved knowledge management, few researchers have contributed to the revolution of knowledge management (Lierni, 2004). Nowadays, knowledge management is directed to a kind of business in major international professional organisations. They have applied knowledge management to their areas of expertise (Lierni, 2004). At the same time, knowledge management has been applied to project management. Some literature review explores mentioned on the awareness and accessibility of knowledge in project risk and it has extended to organisational risk (Lierni, 2004). Knowledge management is able to provide productive information apply, intelligence enhancement, activity improvement, strategic planning, intellectual capital storage, best practice gathering, flexibility acquisition, success probability enhancement and productive collaboration (Kanapeckiene, Kaklauskas, Zavadskas, & Seniut, 2010).

2.2 Project-based Knowledge

In fact, knowledge is an asset to an organisation as competitive advantages on the linkage of core competence and knowledge (Yeong & Lim, 2010). Improper way of managing knowledge during project lifecycle will result in valuable intellectual capital to be devalued and lost efficiency in work. Knowledge can be categorised into two types, tacit knowledge, which is personal knowledge and difficult to be expressed in words and explicit knowledge, which is tangible expressed in words and able to be stored in term of

documents (Seufert, Back, & Krogh, 2003). Seufert et al., (2003) expressed knowledge as a continuous flow process such as localising and identifying; sharing and transferring; creating and applying. In another word, knowledge management is a process to enable new knowledge creation, while improving the innovation. Thompson (2003) argued that knowledge management as a contribution to a cost saving productivity environment. Broad range of explicit knowledge will created, stored, accessed, used and updated during the undergoing of a project (Reich, Gemino, & Sauer, 2012). This research emphasizes on three type of knowledge, the technical solution knowledge (developed by technical team), organisational knowledge (developed by management) and business value knowledge (developed by business team). Reich et al. (2012) stated that knowledge management produces identified team of knowledge within a project, which knowledge is important to complete project goals successfully. Even though, some of the knowledge keep on tacit, but it is still necessary to convert those knowledge to explicit, so that it can be evaluated, monitored, share and modified, and used (Reich et al., 2012). Lessons learned (knowledge) from previous project can benefit to far-reaching changes on strategic focus in an organisation. The knowledge and expertise established within project teams positively impacts to organisational success in creating valuable knowledge in project development (Todorović et al., 2015). Knowledge becomes a solution for problems and technology that might inspirit the project results and technical design knowledge relating to a project implementation (Todorović et al., 2015).

Each type of project-based knowledge is defined below with backup literature.

2.2.1 Knowledge of Technical Solution

Technology has improved rapidly to develop technical roles at the project industry. The idea of project technical improvement is to provide an acceptable technical solution to achieve corporate architectural standards (Reich et al., 2012). Project technical team must able to apply technology into project and integrate technology to improve the design. There are dynamical revolution of technical knowledge, old technology can be emerged with latest technology within the time frame if a project. Reich et al. (2012) defines that technical solution knowledge as a *"dynamic, shared understanding of the*

architecture and infrastructure of the technical solution within the context of any wider architectural standards or infrastructure standards and constraints" (p. 667).

Technical knowledge focuses on the product and services. According to Lehtimaki, Simula, & Salo, (2009) technical knowledge can be categorised to core knowledge and project specific knowledge. Core knowledge is used to improve project teams, but project knowledge is useful for one project and hardly to be used again (Lehtimaki et al., 2009). Project-based organisation need to show that it has competency in technical knowledge and justify that this knowledge is beneficial to the proposed project (Lehtimaki et al., 2009). Besides that, project specific knowledge needs to be highlighted during the diagnosis of customer problems (Lehtimaki et al., 2009). However, core knowledge and project specific knowledge are both important factors in building trust. Each project is distinctive on the technical, trust-generating and people involved, thus, it must be tailored to each individual project (Lehtimaki et al., 2009). Feo (2003) identified that project teams with higher technical knowledge, skills and abilities execute better tasks than those that do not. Besides that, Feo (2003) also stated that bigger project team will contribute larger technical knowledge, which can benefit to projects.

However, Langer et al argue that non-technical or tacit knowledge (soft skills) significantly improve both cost control and client's satisfaction. The impact of soft skills is greater than knowledge of technical solution. Additionally, soft skills is able to improve coordination among the project team and also with clients. Soft skills has been proven to be helpful for project team members to develop and implement better project management practices.

2.2.2 Knowledge of the Organisational Solution

According to project literature, welfares are only protected if a new system is collaborated by business practice and organisational alteration (Reich et al., 2012). Morton (1991) states that the combination models express the gratitude of the strategy, structure, process and people need to be collaborated to core technology systems to attain high performance. Knowledge of the organisational solution refers to the organisational

changes, such as structure changes, processes changes, incentives changes, skills changes and culture changes. These changes required to bring in IT additive and realise value (Reich et al., 2012). Reich et al. (2012) defines knowledge of the organisational solution as *"the dynamic shared understanding of the changes that need to be made in the organisation in order to utilise the technical solution to enable the attainment of the desired business value" (p. 667).*

2.2.3 Knowledge of Business Value

Understanding on desired business value becomes a main success factors for IT project (Reich et al., 2012). Some literature reviewed that IT projects have justified the important of business value (Reich et al., 2012). Reich et al. (2012) emphases that chances may commence throughout a project through the business implication of the technology learning. Reich et al. (2012) defines knowledge of desired business value as a *"dynamic shared understanding of the business objectives that the project is expected to deliver" (p. 666).* Therefore, project team must progressively review on the factor of producing business value.

2.3 Project Management Success Criteria

In fact, project management practices are getting more and more important, some project management standards and methodologies have been established by academic and industrial research to improve project-based organisations (Sokhanvar et al., 2014). The Institute's Project Management Body of Knowledge guide (PMBOK) clearly states that project as a short-term body undertaken to produce an exclusive product or service (Yeong & Lim, 2010). Additionally, project management is explained as "the application of knowledge, skills, tools and techniques to project activities to meet the project requirement" (Yeong & Lim, 2010, p. 9).

On the other hand, PRINCES2 guide defines project as "a temporary organisation that is created for the purpose of delivering one or more business products according to an agreed business case" (Yeong & Lim, 2010). According to the PRINCE2 guide, project management is defined as "the planning delegating, monitoring and control of all aspects of the project, and the motivation of those involved, to achieve the project objectives within the expected performance targets for time, cost, quality, scope, benefits and risks" (Yeong & Lim, 2010, p. 9).

There are another definitions of project and project management from the Project Management Association of Japan (PMAJ). According to PMAJ's Project & Program Management guide (P2M), which is exceedingly considered by the project management professional in Japan, project is defined as a "value creation undertaking based on specific, which is completed in a given or agreed time frame and under constraints, including resources and external circumstances" (Yeong & Lim, 2010). The project management refers to "the professional capability to deliver, with due diligence, a project product that fulfils a given mission, by organising a dedicated project team, effectively combining the most appropriate technical and managerial methods and techniques and devising the most efficient and effective work breakdown and implementation routes" (Yeong & Lim, 2010).

Based on the PMBOK, the improvement in project management can have a major effect on project success (PMI, 2008). The improvement can be justified from the practising of suitable knowledge, process, skills, tools, and techniques (PMI, 2008). The goal of project management is to make sure the project to be accomplished to fulfil the requirement of scope specified by stakeholders, within budget, complete a quality product or service on time (Yeong & Lim, 2010).

In fact, project success can be proven that the project accomplished with the right time, cost and quality (Yeong & Lim, 2010). However, this justification on project success is simplistic and even dangerous (Turner, 2009). Turner (2009) argues that a project was completed on budget and within schedule but after few years it can be judged to be a disappointment. Turner (2009) mentioned that project stakeholder, like sponsors, users

and project manager, have different judgments on project success. It is better to get a balance on project success criteria among project stakeholders (Turner, 2009). There is very difficult to judge whether a project management is successful, a project delivered within budget, construct based on performance requirement and complete on time, but it may not be able to judge whether project was executed properly (Kerzner, 2009).

Turner (2009) lists nine specifications for measuring project success:

- "The project increases the shareholder value of the parent organisation.
- The project generates a profit.
- The project provides the desired performance improvement.
- The new asset works as expected.
- The new asset produces a product or provides a service that consumers want to buy.
- The new asset is easy to operate.
- The project team has a satisfactory experience and the project met their needs.
- The contractors made a profit" (p. 67).

2.3.1 Scope of Work

The scope of work of the project is the benchmark of the deliverable product or services. During the commencement of project, the project team refines the scope of work and improve a preliminary schedule and conceptual budget. The scope of work is documented as design parameter that determine the deliverables of the project. Even a clear project scope document need to change during the project (Clements, Drysdale, Francis, Harrison, Rino, Robinson, & Snyder, 2012). Scope of work reflects to the work need to be accomplished on the project, any alteration in expectations which is not captured creates chances for confusion. The most commonly happens is the incremental expansion in the project scope. This expansion of work affect the success of a project because additional of scope require additional resources. However, amendment of scope of work is a common occurrence (Clements et al., 2012) and this adjustment will impact to project budget and schedule. The ability of a project team leader to identify possibility of amendment will improve the quality of scope documents.

2.3.2 Project Schedule

Project schedule is the project duration from start to completion of the project. Schedule can be an important issue for many clients, it can be primary consideration issue, especially for production clients. Project schedule overruns give impact to a vicious circle problem (Bjarnason & Hochdorfer, 2007). The vicious circle means project team members have to work on too many projects at the same time. Consequently, it is difficult to focus on every single project. Thus, some of project start to slip and it takes extra time and effort to cope up with these schedule and subsequently result in less efficiency in work. Poor project schedule will result in low quality of work and damage the outcome of project and image of overall organisation (Bjarnason & Hochdorfer, 2007). In order to well manage a project, project manager must know how to expedite the schedule to compensate for unanticipated event that cause delay.

2.3.3 Project Quality

The quality refers to the end product or deliverables services that serve the goal of the project (Clements et al., 2012). The project management success is measured from project execution approach that delivered the expected deliverables projects based on specified quality. However, the concept of quality is closely depended on customer satisfaction. Customer satisfaction is justified based on the comparison between the customer's pre-order perceptions and post-order expectations (Eriksson & Westerberg). Project team members is responsible for executing a project quality that documented in quality expectations and assures that the specification and expectations are met. A proper documenting on project specifications and expectations is important to a good quality plan (Clements et al., 2012). These are necessary to integrate into project execution plan. It is as same as project schedule and budget, changes in quality specifications may occur across the project life cycle. Cost and schedule is the impact of changes of quality, because of the limited period of a project and increases the cost of the project. Therefore, time, appropriate skills, materials, and project planning is measurement to project success (Clements et al., 2012). Project-based organisation may use the process improvement tools to identify and improve the baseline processes used on the projects. The PMBOK

has identified that process improvement tools is helpful to monitor cost and schedule improvement opportunities.

2.3.4 Project Budget

The project success often includes commissioning the project within budget (Clements et al., 2012). Controlling the project budget is the critical project management skill. Client would like to complete the project with the shortest period, but this will impact on the budget of the project. The development of cost controlling is necessary to monitoring the budget and company cash flow (Clements et al., 2012). According to Clements et al. (2012), the project budget is associated to the number of information known by the project team. At beginning stage, the information needed to work out the costing is limited. To solve this issue, the project team need to develop different level of cost estimation. This estimation required the expert knowledge or past experience (Clements et al., 2012). Traditionally, well controlling on project cost can be seen as a success in project management (Eriksson & Westerberg).

2.4 Theoretical Framework

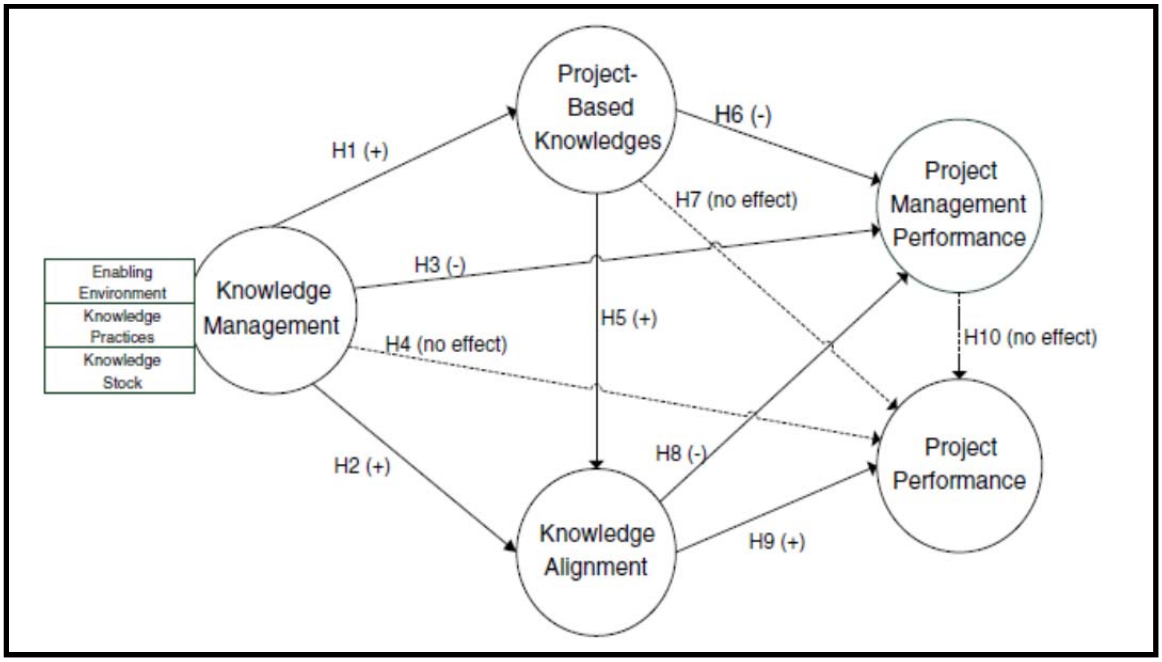
Section 2.1, 2.2 and 2.3 explained the knowledge management and project management. This section discusses the theoretical framework of knowledge management with project management to make project success.

2.4.1 Integrating Project-based Knowledge with Project Management Performance

Figure 2 explains the theoretical framework that knowledge management involves of knowledge stock, enabling environment and knowledge practices (Reich, Gemino, & Sauer, 2014). These three knowledge produce project-based knowledge, which pertain to knowledge of the technical solution, knowledge of the organisational solution and

knowledge of expected business value. Both knowledge management and project-based knowledge give impact to level of knowledge alignment in the project. Knowledge alignment refers to the similarity of understanding of the teams. Conclusively, knowledge management, project-based knowledge and knowledge alignment will influence both project management performance and project performance (Reich et al., 2014).

Figure 2: Theoretical Framework of Project-based Knowledge Management



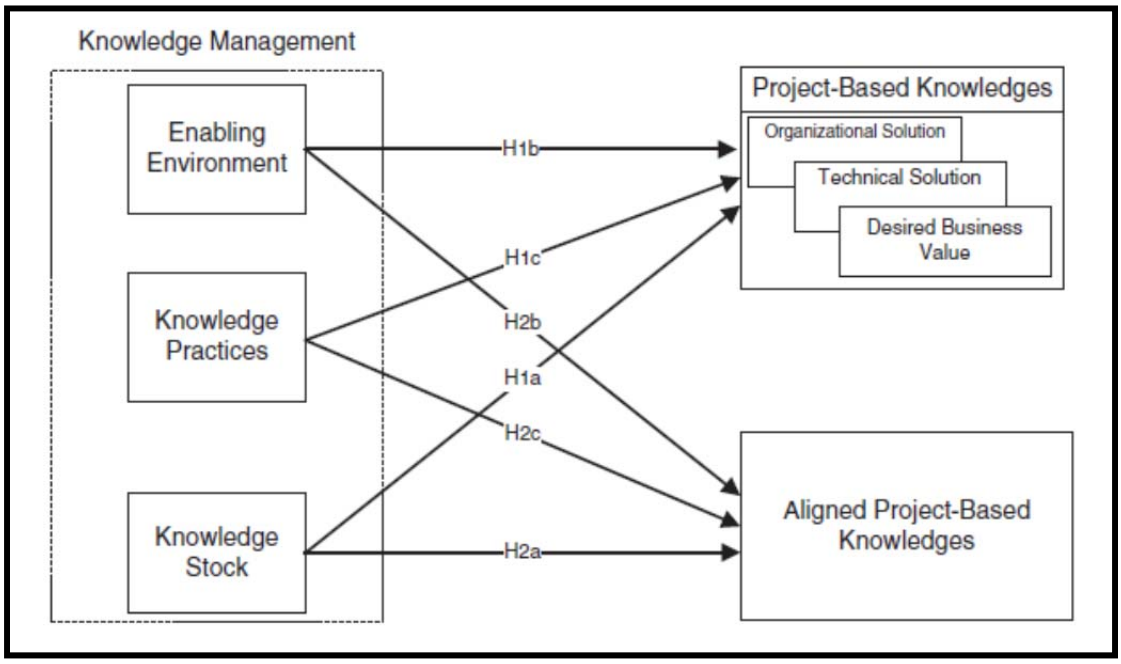
Note. Sourced from Reich, B. H., Gemino, A., & Sauer, C. (2014). How knowledge managment impacts performance in project: An empirical study. *International Journal of Project Management, 32*, 590-602.

This framework showed that the goal of knowledge management is two-fold (Reich et al., 2014). The first goal is to achieve the project's business value through technological and organisational solutions. The second goal is to achieve a level of shared understanding across the professional team. The organisational team in-charge on business change and the business sponsors with knowledge must achieve for the business.

The first goal is to ensure the proposed solution for the project should obtain the business successive. The second goal is to ensure sufficient sharing and understanding among the team during executing of the project. In case of unanticipated changes, other team members can recognise the impacts and solutions. According to Reich et al. (2014), the purpose of knowledge management does not create equality knowledge among project team members, but to equip them to understand their expertise and alert to the consequences on their decision make to give impact to others.

Figure 3 refers to the two principal basics of knowledge management and project-based knowledge. There are three dimensions of knowledge management contains of knowledge stock, enabling environment and knowledge practices (Reich et al., 2012). This model represents that knowledge is produced from knowledge practices, using knowledge stock as contribution and working within an enabling environment. Thus, knowledge management impacts to project-based knowledge and aligned project-based knowledge (Reich et al., 2012). Additionally, project-based knowledge created from three key type, such as organisational solution, technical solution and desired business value.

Figure 3: Knowledge Management Dimensions and Project-based Knowledge



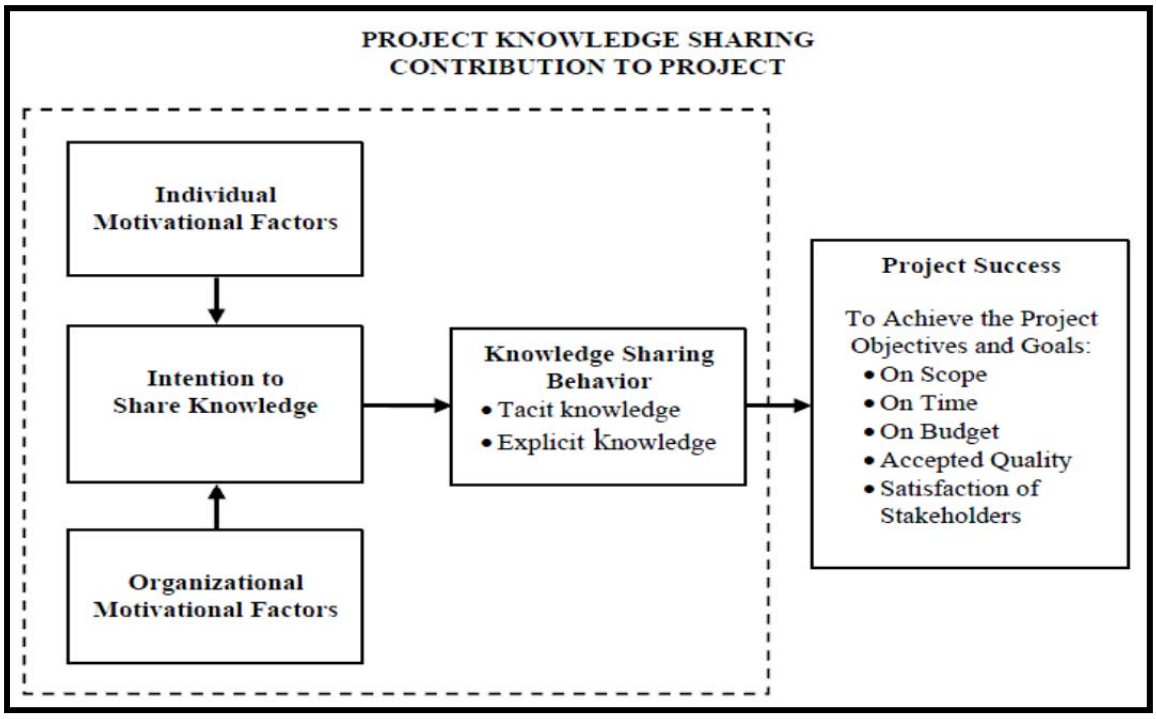
Note. Sourced from Reich, B. H., Gemino, A., & Sauer, C. (2012). Knowledge management and project-based knowledge in it projects: A model and preliminary empirical results. *International Journal of Project Management, 30*, 663 - 674.

Additionally, the role of effective knowledge management is proven to produce innovation, reduce project time and improve quality and customer satisfaction (Kanapeckiene et al., 2010). Other researchers mentioned that knowledge management is able to create value for organisation's intangible assets and both internal and external knowledge, thus useful to the organisations (Kanapeckiene et al., 2010). In fact, projects knowledge management can enhance communications within teams through providing more informative sharing on best practice documents, project management and system engineering methodologies, lesson learned, and review rationales of strategic decisions making (Kanapeckiene et al., 2010).

2.4.2 Integrating Knowledge Management with Project Management

Ismail, Nor, & Marjani (2009) studied the method of individual knowledge sharing in project environment. This research theoretical framework (figure 4) shows that delivering appropriate motivator and eliminating applicable inhibitors to sharing knowledge and experience would contribute to the more effective and efficient in project knowledge sharing and increase to the project success rate (Ismail et al., 2009). This model was referred to Nonaka's Knowledge Conversion Model (1998) and emphasises on the socialisation of tacit knowledge. Inclusively, Ismail et al. (2009) explained that the essential for project success is based on the process of tacit and explicit knowledge sharing.

Figure 4: Proposed theoretical framework for project knowledge sharing contribution to project



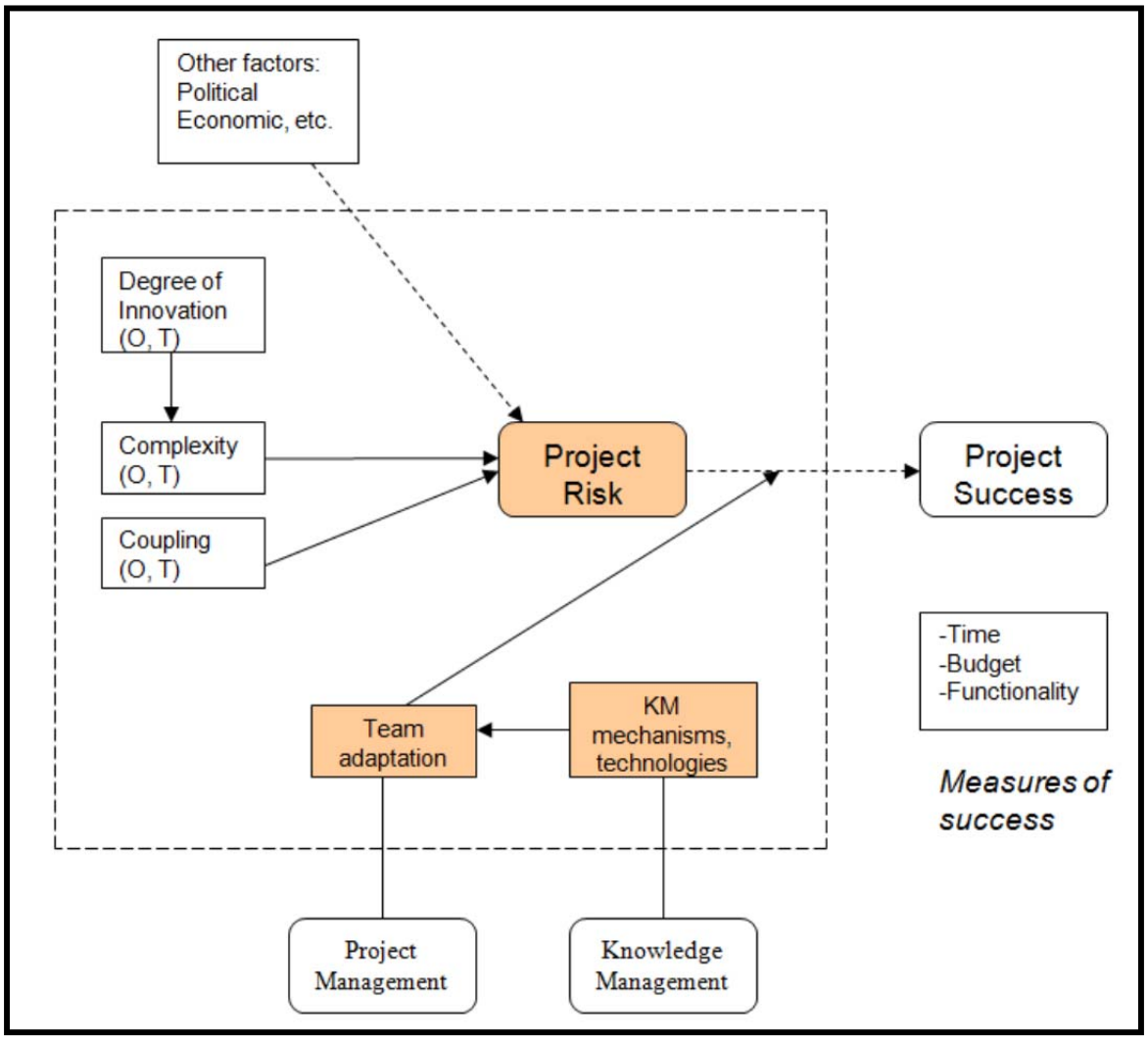
Note. Sourced from Ismail, W., Nor, K., & Marjani, T. (2009). *The role of knowledge sharing practice in enhancing project success.* Institute of Interdisciplinary Business Research.

Cope III, Cope, & Hotard (2006) also conclude that knowledge management practices that to improve project management. If both tacit and explicit knowledge from previous projects could be identified and shared on the new project, it would beneficial to the organisation (Cope III et al., 2006).

Project managers agreed that the use of knowledge management practices is positively impacted on the management of project (Lierni & Ribiere, 2008). Shared Repository pf Project Artifacts, Lessons Learned and Best Practices Repositories, and Document and Content Management Systems are the most adoptable knowledge management practices to helping project manager (Lierni & Ribiere, 2008). Lierni & Ribiere (2008) suggest that explicit knowledge sources comes first, but project managers gain knowledge from knowledge sharing and codifying tacit knowledge from former projects.

Another framework, proposed by Gudi & Becerra-Fernandex (2006), this framework emphasise that the motivation to diminish risk and prevent failure through the focusing on the dynamic feature of project management using knowledge management as shown in figure 5 (Gudi & Becerra-Fernandez, 2006).

Figure 5: Knowledge management and project/program management linked



Note. Sourced from Gudi, A., & Becerra-Fernandez, I. (2006). Role of knowledge management in project management if complex systems organizations. *NASA Knowledge Management and Successful Mission Operations Conference 2006.* Houston, TX.

The understanding of natural risk of the systems will minimise or eliminate risk of failure and improve the opportunity of project success (Gudi & Becerra-Fernandez, 2006). When project develops more complex, organisation has to understand the inter-related activities of the project, in order to recognise knowledge management strategies. These strategies are able to reduce project failure rate and increase project success rate (Gudi &

Becerra-Fernandez, 2006). Knowledge management mechanisms, process and technologies are suitable for project management requirement. In fact, political and economic factors (external), innovation and complexity factors (internal) will influence to project risk (Yeong & Lim, 2010). Same as previous literature, project success refers to scheduling, budget and functionality.

Finally, Levin (2010) states that effective knowledge management execution is the main success of project management in project-based organisations. Knowledge management has to be combined with project management for rapid feedback to collect data in order to provide solution to the problems and share information effectively and efficiently (Levin, 2010). The necessary to combine knowledge data base to project management so the project team can integrate individual contributions to complete the project's goal and bring into cooperation to achieve organisation's strategic objectives (Levin, 2010).

There are nine guidelines for organisation to have successful execution and integration of knowledge management with project management:

- "Define knowledge management so that everyone in the organisation can understand it
- Make knowledge management to be a work package in the work breakdown structure of every project
- Establish a point of contact for knowledge management on each program and project working with the Enterprise Project Management Office
- Use a Responsibility Accountability Matrix (RAM) to define roles, responsibilities, and accountabilities for knowledge management
- Communicate the importance of knowledge management to all stakeholders throughout the organisation
- Provide knowledge management orientation and training to all stakeholders
- Establish a practical knowledge management reward and recognition system
- Track the usefulness of knowledge management by using metrics
- Organisation should focus on continuous improvement" (Levin, 2010).

2.5 Proposed Project-based Knowledge and Project Management Success Framework

Based on the literature study, the proposed framework has been generated from the merging of three models of knowledge management and project management as below:

- Model of knowledge management dimensions and project based knowledge (Reich et al., 2012)
- Model of project-based knowledge management (Reich et al., 2014)
- Model project knowledge sharing contribution to project (Ismail et al., 2009).

As discussed in section 2.4.1, the previous research model represents that knowledge is produced from knowledge practices, using knowledge stock as contribution and working within an enabling environment. Thus, knowledge management will affect project-based knowledge and aligned project-based knowledge (Reich et al., 2012). There are three type of key project-based knowledge creation, which includes organisational solution, technical solution and desired business value.

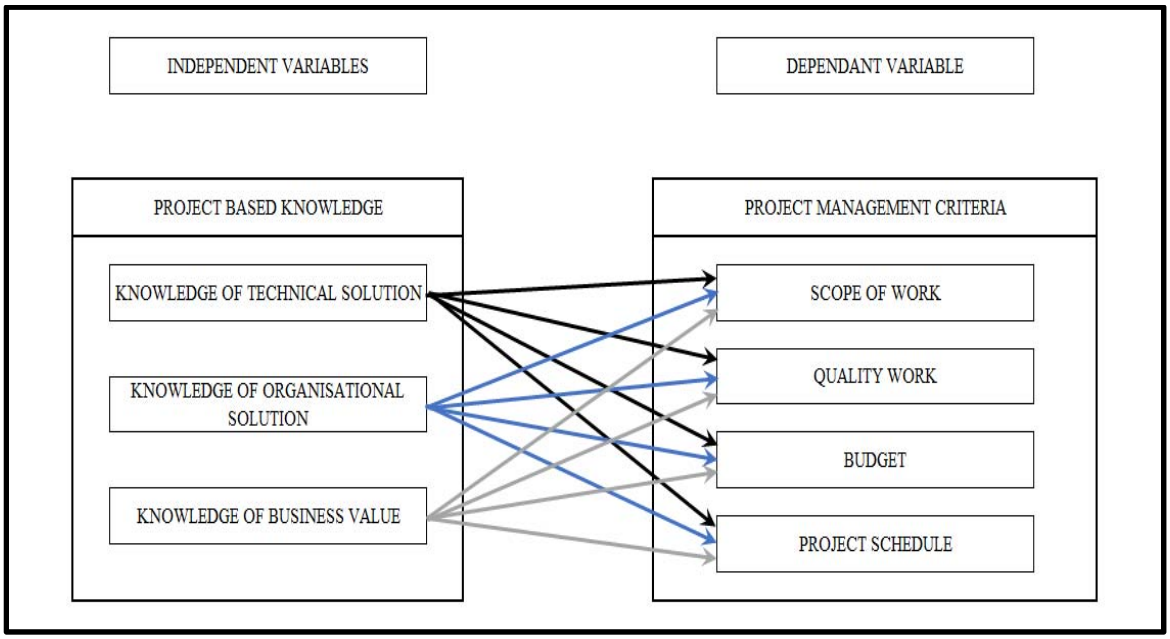
Since, theoretical framework of project-based knowledge management (Reich et al., 2014) represents that knowledge management, project-based knowledge and knowledge alignment will influence both project management performance and project performance.

However, Ismail et al. (2009) explained that the essential for project success is based on the process of tacit and explicit knowledge sharing. The project management success is measure from scope of work, project cost, completion within schedule and quality of project (Ismail et al., 2009).

2.6 Conceptual Framework

Three project based knowledge influence on project management success criteria will be studied in this research. Project-based knowledge can have significant impact on the project management success. Therefore, the combination of theoretical models study the contribution of knowledge contribution to project management performance in engineering project-based organisations as shown in figure 6. Finally, the relationship between knowledge can be determined. The framework below defined the research objectives and research questions as stated in chapter 1.7 and 1.8 respectively. The independent Variables (IVs) of the Project-based Knowledge we turned into hypotheses. The researcher used statistical tests to analyse the potential relationship between the IVs and DVs (Figure 6).

Figure 6: Conceptual Framework



The next chapter, chapter 3 presents the methodology of the research used in analytic the relationship and correlation of project-based knowledge and project management success criteria.

2.7 Hypotheses

H1a) There is a significant relationship between knowledge of technical solution and scope of work in project management.

H1b) There is a significant relationship between knowledge of technical solution and quality of the project.

H1c) There is a significant relationship between knowledge of technical solution and controlling cost of project.

H1d) There is a significant relationship between knowledge of technical solution and project schedule control.

H2a) There is a significant relationship between knowledge of organisational solution and scope of work in project management.

H2b) There is a significant relationship between knowledge of organisational solution and quality of the project.

H2c) There is a significant relationship between knowledge of organisational solution and controlling cost of project.

H2d) There is a significant relationship between knowledge of organisational solution and project schedule control.

H3a) There is a significant relationship between knowledge of business value and scope of work in project management.

H3b) There is a significant relationship between knowledge of business value and quality of the project.
H3c) There is a significant relationship between knowledge of business value and controlling cost of project.

H3d) There is a significant relationship between knowledge of business value and project schedule control.

2.8 Scope of Study

Project-based organisations have gain more interest in emerging organisational structure to intellectual resource to develop organisational culture and innovation (Ajmal, 2009). By improving organisational economy, project organisations reinforce their knowledge resources in an efficient method (Ajmal, 2009). Knowledge management in the environment of a project-based business planning is increasing in sustaining competitive advantage. According to (Love, Fong, & Irani, 2005), knowledge management is an alternative task among project-based organisations because these organisations require organisational mechanisms for knowledge transfer from one project to others project. This research focuses on exploring the project-based knowledge correlated to project management success among project-based organisations. The goal of this research is to develop an understanding of impact of knowledge management to the project management. This can be used as a measuring tool on implement the project knowledge among project-based organisations.

CHAPTER 3

RESEARCH METHODOLOGY

3.1 Overview

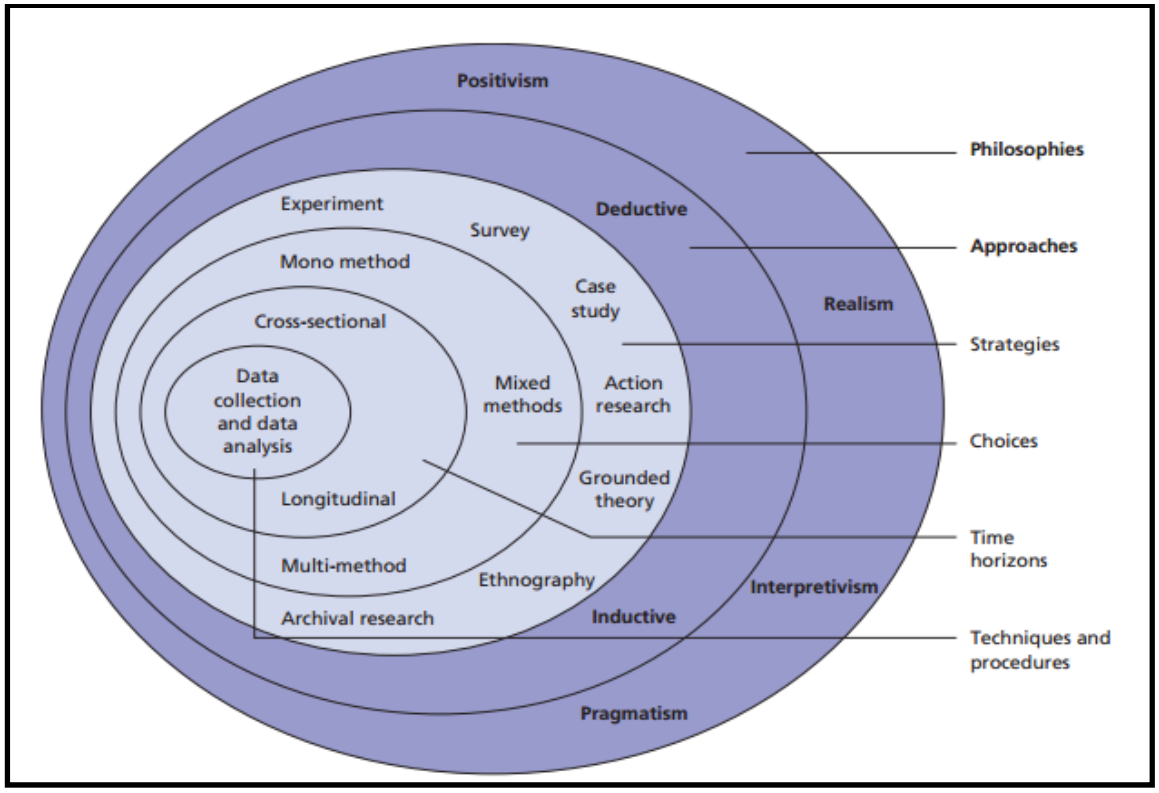
This chapter consists of the research methodology and questionnaire development and design which describe more on survey research and questionnaire design and content issues. Survey questionnaire is distributed to engineering project-based managers and engineers, to study the contribution of project-based knowledge on project management performance. This descriptive and inferential statistical analyses were conducted using the 0.05 confidence level to determine statistical significance. As stated in chapter 1, this research is to study the contribution of knowledge management to project management performance in engineering project-based organisations. The research topic covers across the project-based knowledge.

3.2 Research Methodology

Research methodology based on research onion (Saunders & Tosey, 2013), it describes the stages that must be included when starting a research strategy (Kura, 2012). The Research Onion provides a progressive method for research methodology design. This research focuses on obtaining data from engineering project-based organisations. Survey questionnaire is used to collect data of the research. Selection of techniques used to obtain data and analyse these data to represent the overall research design. Research

onion directs researcher's understandings from outer layers that give the context and boundaries within the data collection techniques and analysis method to be taken.

Figure 7: Research Onion



Note. Sourced from Saunders, M., Lewis, P., & Thornhill, A. (2009). *Research methods for business students* (5th ed.). England: Pearson Education Limited.

This research studies the contribution of knowledge management on project-based performance. It covers relationship between project-based knowledge and the success of project management within the engineering project-based organisations. A variety of researches have been conducted in the field of project management (Ajmal, 2009). This research makes use of a quantitative approach to conduct an empirical part, it is dealing with cause and effect thinking, reduction to specific variables, questions and hypotheses, measuring and testing (Ajmal, 2009). Quantitative research is an appropriate study to be

conducted, it is suitable to identify the signification relationship between independent variables and dependent variables (Ajmal, 2009).

3.2.1 Research Philosophy of Positivism

Research philosophy explains how data will be collected, analysed and applied. It refers to believe of concerning of the nature of the reality being studied (Saunders, Lewis, & Thornhill, 2009). Philosophy is defined as a kind of knowledge being studied in the research (Essays, 2013). Understanding of research philosophy being employed, it can aid to describe the assumptions inherent in the research process and how this suits the methodology being engaged (Essays, 2013). Positivism recognized that reality is stable on the phenomena being studied (Kura, 2012). According to Hinkelmann and Wistshel, positivist believes in the possibility to observe and describe reality from an objective viewpoint. It observe the world in some neutral and goal, derive theories, and discover universal laws. Positivism generates hypotheses which can be tested and explanted against existing laws and theories.

3.2.2 Deductive Research Approach

There are two types of research approaches, the deductive approach and inductive approach (Saunders et al., 2009). The deductive approach states the hypotheses upon a pre-existing theory, then derives the research approach to test it (Saunders et al., 2009). Deductive approach is the best fit to contexts the research studying on the observed phenomena suit with expectation based on previous studies (Essays, 2013). Deductive approach suits to positivist approach, which allows the derivation of hypotheses and statistical analysis of expected outcomes to an acceptable level of probability (Essays, 2013). Deductive approach can be used for qualitative research techniques, therefore the expectations on previous studies would be formulated differently than the hypotheses testing (Saunders et al., 2009). This approach uses general theory to establish knowledge gain from the research process and then tested against it (Kothari, 2009).

3.2.3 Descriptive Research Approach

Descriptive research approach refers to the method of research question, design and data analysis that to be used to a given topic. Descriptive researches focus on "what is" in order to find out the answer of the research questions and usually to be used to collect descriptive data (Spector, Merrill, Elen, & Bishop, 2014). Descriptive research does not restrict to quantitative research but it also applies to qualitative research (Borg et al., 1993). Descriptive studies analysis measure mean, median, mode, deviance from the mean, variation, percentage, and correlation between variables (Spector et al., 2014). Survey research usually take into consideration on the type of measuring and goes beyond the descriptive statistics to get conclusions (Spector et al., 2014).

3.2.4 Research Strategy Using Survey

The research strategy is the method of researcher to collect data and conclude the pattern of the study, the strategy of study consists of experimental research, action research, case study research, interviews, surveys or a systematic literature review (Saunders et al., 2009). Surveys methods tend to be used in quantitative research, sampling size need to be representative proportion to the population (Saunders et al., 2009).

3.2.5 Mono Research Method

There are three choices of research method, such as mono-method, mix-method and multi-method (Liu, 2013). Research can be qualitative, quantitative or a combination of both. As the names of choices, mono-method is using single research approach for the study (Essays, 2013). Mixed-method consists of two or more methods of research (Essays, 2013). For mono method quantitative research, data were collected through survey questionnaire, the quantitative research is more suitable to be used to examine the relationship between variables (Liu, 2013).

3.2.6 Cross-sectional Research Time Horizons

The Time Horizon is the time frame for research to be completed (Essays, 2013), it can be categorized into cross-sectional studies and longitudinal studies. The cross sectional time horizon is an established time frame, which the data must be taken (Essays, 2013). This states that data are collected within a period of time. Cross-sectional research applies to the study that concern the research phenomenon at a specific time (Sekaran & Bougie, 2009). Saunders et al. (2009) specified that cross-sectional studies usually use for survey strategy, it can be used to describe the incidence of a phenomenon, like the IT skills possessed by managers in an organisation at a specific time or how factors are related in different organisations.

3.2.7 Quantitative Data Collections and Quantitative Data Analysis

Quantitative and qualitative studies are used generally in business and social research. Qualitative is used mainly for interview as a data collection technique and categorising data procedure as a data analysis method. In contrast, quantitative is generally using questionnaire as a data collection method and statistical or graph analysis to study data (Saunders et al., 2009).

For social science research, questionnaires is the greatest used survey strategy (Sekaran & Bougie, 2009). In fact, questionnaires data collection technique is the most common technique and efficient way of collecting data from a large designated sample (Saunders et al., 2009). Before using questionnaire survey, researcher need to ensure that survey will collect the precise data to answer research questions in order to achieve research objectives. However, questionnaires are not recommended to be used for a research involve large numbers of open-ended questions (Saunders et al., 2009). According to Saunders et al. (2009), survey questionnaire work best with standardised questions that can be easily understand and same interpretation by all respondents. Even though, questionnaires can be used as a data collection method, it is better to connect them with other workable methods as a multiple-methods research design (Essays, 2013).

There are variety of factors will influence on the choice of questionnaire (Saunders et al., 2009, p.363):

- "Characteristics of the respondents from whom you wish to collect data.
- Importance of respondents' answer not being contaminated or distorted.
- Importance of reaching a particular person as respondent.
- Size of sample you require for your analysis, taking into account the likely response rate.
- Types of question you need to ask to collect your data.
- Number of questions you need to ask to collect your data".

Quantitative data is a raw of numbers, need to be processed to make them useful to become information to researcher. Charts, graphs and statistics help to describe and examine relationships and trends within collected data (Saunders & Tosey, 2013). In fact, social science and business management research involve some numerical data to be quantified in order to answer research questions and meet research objectives (Saunders et al., 2009). Quantitative data can be categorised into two group, categorical and numerical. Categorical data refer to data cannot be measured numerically but can be group into categories based on characteristics (Saunders et al., 2009). However, numerical data can be measured or countable, this means that numerical data are more accurate than categorical as it can be analysed using statistics (Saunders et al., 2009).

3.3 Research Design

The purpose of this study is to determine if there is a significant relationship between project-based knowledge and the project management success. The outcome of the research will give better understanding of which (if any) project-based knowledge are able to improve project management success. If these knowledge management is applicable to improve project management, an expansion of knowledge management in project-based organisations will be apply accordingly.

The research employed a descriptive and survey questionnaire evaluation design. Researcher liaises with Project Management Institute (PMI) Malaysia for the respondents name list. PMI is a worldwide recognised non-profit project management professional association. Therefore, the results should mainly allow the researcher to conduct a findings on the research objectives (Lierni, 2004). This study focuses on the project-based organisations in Malaysia. Targeted companies must be doing engineering project. The list of targeted samples is provided by Project Management Institution, Malaysia. The respondents of the survey form must be a project manager of engineering project-based company. To achieve the objective of this research, the following four research questions were examined:

a) What are the contribution of knowledge management towards project management?
b) How to relate project-based knowledge categories to success project management criteria?
c) What are the factors of implementation knowledge management in success project?
d) What are the difficulties of execution knowledge management in engineering companies?

3.4 Data Collection Methods

This research data were collected through survey questionnaire. The survey design a single-stage and cross-sectional and data collected at one point in time. Surveys are always the most appropriate strategy apply to research, which allow questions to directly aim specific topics (Lierni, 2004). According to Lierni (2004), the speed of collection as well as economy method are the benefits of choosing survey as a data collection. It also protect respondents as the data to be collected anonymously. The survey was gone through both web-enabled and papered copy. The survey questionnaire is shown in Appendix A. As this study is to measure project managers' perception of the knowledge management practice in assisting project management success. Knowledge can be categorised into Knowledge of Technical Solution, Knowledge of Organisational

Solution and Knowledge of Business Value (Reich et al., 2014). These three dimensions consist of holistic measurement on knowledge management in project-based engineering organisations. Perhaps, project management success can be measured in term of scope of work, innovative design, project completion within budget, and project commissioning within project schedule (Yeong & Lim, 2010). Several previous studies on knowledge management adapted and adopted to design the questionnaire for this study.

Based on conceptual framework, multiple supporting dependent variables formed primary dependent variable of the research which is "Project Management Success Criteria", as well as the multiple independent variable of the research is "Project-based Knowledge".

Survey questionnaire used to measure the perception of project managers in their passed project experience. This questionnaire was comprehensively covering every dimensions of project manager experience. The survey questionnaire with Five-Likert Scaling (1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree) will be used to measure the variables of knowledge management dimension. A categorical measuring method (Yes or No) to be used to determine respondents perception on project management success criteria. Respondents will be asked to indicate the degree of their perspective on their knowledge on technical solution, organisational solution and business value in their organisation and their project performance as a project team members.

3.5 Sampling Procedures

PMI is one of the accredited bodies in Malaysia, which is the world's leading not-for-profit professional membership association for the project, program and portfolio management profession. It founded in 1969 and delivers value for more than 2.9 million professionals working in nearly every country in the world through global advocacy (PMI, 2014).

PMI provided a name list consists of 150 project managers, project engineers or project relevant team members for this study. 50 samples selected from the ages of 20 year old to 30 year old, another 50 samples in the age of 31 year old to 40 year old, and another 50 samples selected from the age more than 51 year old. All sample must be serving at Malaysian engineering organisation, either located in Malaysia or overseas. Based on the name list, company of the respondents' background should be studied to know the nature of business; to make sure that project team members are from engineering company. Survey form will be send through email or post to respondents. After two weeks from the initial survey questionnaire released, two reminder emails will be sent to follow up on the reply.

Ethics is an important practice and should be taken to protect respondents. Mainly, the acceptability of respondents to provide information and perception to the researcher needs to be respected. The researcher need to get the consent of the volunteer respondents before survey to be conducted. However, respondents have right to determine their willingness to answer to questionnaire (Liu, 2013). According to Liu (2013), there are disputes of the respondents' confidential and protection. Respondents' details would be identified and released. Based on Sekaran & Bougie (2009) suggestion, samples size which are larger than 30 and less than 300 are normally applicable to most of the research.

3.6 Survey Instrumentation Description

The survey questions in Appendix A were adapted and adopted from literature review. Literature review focused into the knowledge management contributed to project management success criteria. These knowledge can be segregated into knowledge of technical solution, knowledge of organisational solution and knowledge of business value (Reich et al., 2014). The survey instrument contained of three sections. Section One of the survey questionnaire indicated the biographical of the respondents.

Section Two of the survey questionnaire consisted of three types of project-based knowledge. Type A of section two measured the knowledge of technical solution. These consisted of eight questions to test on the understanding and importance of technical knowledge to be applied in project-based organisations. In fact, the knowledge build up from the project team members, who willing to create a learning ambient and share their technical knowledge. According to Feo (2003), projects need technical knowledge to execute the projects tasks. The systematic of knowledge stocking and knowledge sharing mechanisms to be expected in working environment (Reich et al., 2004). Researcher would expect the high degree of technical knowledge sharing and practices would positively impact to the success of project management. Feo (2003) stated that project-based organisations require three critical activities to managing the technical knowledge. These are identification of critical knowledge (technical training, capture project data, create deliverables), detection of knowledge sources (create technical knowledge database) and validation of technical knowledge (providing standard operating procedure). The main goal of technical knowledge management is to encourage learning by providing projects with suitable knowledge. Conclusively, if project team are encouraged to be more opportunities on technical sharing practice, then the documents created by the project might be of better quality.

Type B of section two measured the knowledge of organisational solution. These contained of six questions to test on the degree of organisational knowledge of the respondents. Organisational knowledge create connection among division of organisations (Feo, 2003). This enable the team to share information more effectively with the key man of the organisations. Top management support is the key factor of the implementation process. The tangible and intangible support can build up the project team and overcome organisational barriers. Organisational assessment is important to be consider for making changes across the department on project-based organisations. The understanding of cross department among organisation can avoid an inconvenient allocation of organisational resources and minimises the probability to create a culture clash and create negative impact to members of the organisation (Feo, 2003).

Type C of section two focused on the business value knowledge owned by respondents. There were four questions to be used. These questionnaires were adapted and adopted from Lierni (2004), Reich et al. (2014), and Reich (2012). In the business context knowledge, these capability measured from business strategy (efficiency and marketing strategy), business culture (relationship) and learning capability (suitable solution) (Feo, 2003).

Section three of survey questionnaire contained of four criteria to measure the success of project management. Question D1 used to measure the experience and understanding of respondents on the criteria of scope of work of the involved projects. The factors of failure of controlling the scope of work would be indicated in question D1a.

Question D2 used to measure the experience and understanding of respondents on the criteria of controlling the project schedule of the involved projects. The factors of failure of controlling the project schedule would be indicated in question D2a.

Question D3 used to measure the experience and understanding of respondents on the criteria of quality of project to be delivered. The factors of failure of controlling the quality of work would be indicated in question D3a.

The last criteria, question D4 used to measure the experience and understanding of respondents on the criteria of cost handling of the involved projects. The factors of failure of controlling the budget would be indicated in question D4a.

3.7 Data Analysis Techniques

IBM Statistics Package for the Social Sciences (SPSS) 22.0 as an analytical tool to analyse the proposed hypotheses. After collecting data, researcher conducted a normality and reliability test. Normality test is used to analyse a symmetrical, bell-shaped curve, which has the greatest frequency of scores in the middle, with smaller frequencies

towards the extremes (Pallant, 2005). This test is based on assessment on skewness and kurtosis values. The skewness value indicates the symmetry of the distribution A positive skewness value means right skew; a negative means left skew, the greater the absolute value, the greater the skew. Kurtosis value indicates the "peakedness" of the distribution, positive kurtosis indicates that the distribution is rather peaked with long thin tails, negative kurtosis value means the curve is relatively flat. If the distribution is perfectly normal when skewness and kustosis value of zero.

There are few types of statistical method to assess reliability. One of the most common method is analysis based on Cronbach's alpha coefficient. Therefore Cronbach alpha test is used to measure internal consistency of the instrument. Ideally, the Cronbach alpha coefficient of a scale should be more than 0.7 (Pallant, 2005). According to Sekaran & Bougie (2009), reliabilities less than 0.6 are considered to be poor, 0.7 are considered to be acceptable and over 0.8 are considered to be good.

Table 1: Knowledge of Technical Solution Reliability Statistics

Item	Mean	Std Deviation	N	Cronbach's Alpha	N of Items
KTS1	4.000	.67937	40	.819	8
KTS2	3.575	.93060	40		
KTS3	3.675	.82858	40		
KTS4	3.950	.55238	40		
KTS5	3.900	.59052	40		
KTS6	3.850	.69982	40		
KTS7	3.750	.70711	40		
KTS8	3.825	.67511	40		

In terms of reliability the most important figure is the Alpha value. This is Cronbach's Alpha coefficient, which is .819 for knowledge of technical solution data. This value is above .8, so the scale can be considered reliable with the sample.

Table 2: Knowledge of Organisation Solution Reliability Statistics

Item	Mean	Std Deviation	N	Cronbach's Alpha	N of Items
KOS1	3.725	.67889	40	.845	6
KOS2	3.575	.81296	40		
KOS3	3.850	.48305	40		
KOS4	4.000	.55470	40		
KOS5	3.625	.74032	40		
KOS6	3.550	.71432	40		

Cronbach's alpha coefficient of knowledge of organisational solution data is .845. This value is above .8, so the scale can be considered reliable with the sample.

Table 3: Knowledge of Business Value Reliability Statistics

Item	Mean	Std Deviation	N	Cronbach's Alpha	N of Items
KBV1	3.825	.74722	40	.848	4
KBV2	3.925	.61550	40		
KBV3	3.775	.73336	40		
KBV4	3.975	.69752	40		

Cronbach's alpha coefficient of knowledge of business value data is .848. This value is above .8, so the scale can be considered reliable with the sample.

Bivariate Correlation test shows the relationship between two variables in a linear function (Coakes & Ong, 2011), as variable increases, the other also increase or as one variable increases, the other variable decreases. A Pearson product-moment correlation can be used to correlate a dichotomous and a continuous variable. Correlation between two continuous variables is the most common measure of linear relationship. The Pearson value correlation (r) can range from -1.00 to 1.00. This value will indicate the strength of the relationship between two variables. A correlation of zero indicates no relationship between the two variables. A correlation of 1.0 means a perfect positive correlation, and a value of -1.0 means a perfect negative correlation. Cohen (1988) states that r = .01 to .29 or r = -.01 to -.29 (weak relationship), r = .30 to .49 or r = -.3 to -.49 (medium strength relationship), r = .50 to 1.0 or r = -.50 to -1.0 (high strength relationship) and summarised in table 4 (Pallant, 2005).

Table 4: Pearson Value Strength

Pearson Value, r	Strength Relationship
.01 to .29 -.01 to -.29	Weak
.3 to .49 -.3 to -.49	Medium
.05 to 1.0 -.05 to -1.0	High

The value indicates the strength of the relationship, while the sign (+ or -) indicates the direction. There is a positive correlation when one variable increases, so too does the other, negative correlation indicates that as one variable increases, the other decreases. The size of the absolute value provides an indication of the strength of the relationship. Each of the knowledge management dimensions will be tested with project success measurement to conclude all hypotheses.

Multiple regression is an extension of bivariate correlation. The result of regression is an equation that represents the best prediction of a dependent variable from several independent variables. Regression analysis is used when independent variables are correlated with one another and with the dependent variable. Independent variables can be either continuous or categorical. For this study, project success is dependent variable and knowledge management (Knowledge of technical solution, Knowledge of organisational solution, and business value) are independent variables. The result of this test will show the model of project success with three knowledge dimensions.

CHAPTER 4

RESEARCH RESULTS

This chapter describes the details of the data collected and output data from SPSS. The purpose of this data is to answer the research questions in chapter 5. In order to answer research questions, analysis test is required and results tabularised as below.

4.1 Frequency

The population of research consisted of project team members in Malaysia. In total of 40 respondents replied to the survey. Table 5 shows that there are 29 males (72.5%) respondents and 11 female (27.5%) respondents in this survey.

Table 5: Frequency Table for Gender

	Frequency (N)	**Percentage (%)**
Males	29	72.5
Female	11	27.5
Total	40	100

There are in the age range of 21 year old to 60 year old (shown in table 6). The largest group of respondents' ages of 21 year old to 30 year old (47.5%). This shows that majority of young project team members willing respond to the survey questionnaire. The second largest group of respondents' ages fall between 31 year old and 40 year old (37.5%). 12.5% of respondents in the ages ranges of 41 year old to 50 year old. Finally, there is only 2.5% of respondent above 51 year old.

Table 6: Frequency Table for Age

	Frequency (N)	Percentage (%)
21 – 30 year old	19	47.5
31 – 40 year old	15	37.5
41 – 50 year old	5	12.5
51 year old and above	1	2.5
Total	40	100.0

Table 7 shows the year of participants' experience in this survey. There are 72.5% of respondents have undergone less than six years project management experience. 15% of respondents have six to ten years project management experience. In the group of 11 to 20 years experiences respondents consist of ten percent of the total respondents. Additionally, that is 1 respondent has 21 year experience in project management.

Table 7: Frequency Table for Years of Experience

	Frequency (N)	Percentage (%)
Less than 6 years	29	72.5
6 - 10 year	6	15.0
11 – 20 year	4	10.0
21 year old and above	1	2.5
Total	40	100.0

Table 8 summarises that 47.5% of respondents perform as a project engineer and 20% as a project manager. It follows by 12.5% of tender engineer. Besides that, ten percent of respondents are top management of the project-based organisations. The rest of respondents came from project executive and project sales personnel with 7.5% and 2.5% respectively.

Table 8: Frequency Table for Job Category

	Frequency (N)	Percentage (%)
Tender Engineer	5	12.5
Project Engineer	19	47.5
Project Executive	3	7.5
Project Sales Personnel	1	2.5
Project Manager	8	20.0
Top Management	4	10.0
Total	40	100.0

Table 9 summarises the respondents by industry. The largest group of respondents (40%) came from construction industry. The other industries with the second and third largest group of respondents were the environmental and automotive industries with 25% and 15% respectively. Besides that, ten percent respondents came from oil and gas industry. It follows by five percent from electrical and instrumentation industry and 2.5% come from power industry.

Table 9: Frequency Table for Industry Category

	Frequency (N)	Percentage (%)
Automotive	6	15.0
Construction	16	40.0
Electrical & Instrumentation	2	5.0
Environment	10	25.0
Power	1	2.5
Oil & Gas	4	10.0
Others	1	2.5
Total	40	100.0

4.2 Tests of Normality

Normality data assessment is a prerequisite for many statistical tests. It is important for underlying assumption for parametric testing. There are two type of assessment methods, which are graphical method and numerical method.

Table 10: Test of Normality and Descriptive for Knowledge of Technical Solution, Knowledge of Organisational Solution and Knowledge of Business Value

Variables	Kolmogorov-Smirnov[a]			Shapiro-Wilk			Skewness		Kurtosis	
	Statistic	df	Sig.	Statistic	df	Sig.	Statistic	Std Error	Statistic	Std Error
AVGKTS	.174	40	.004	.932	40	.019	-.249	.374	.790	.733
AVGKOS	.213	40	.000	.866	40	.000	-1.215	.374	1.531	.733
AVGKBV	.240	40	.000	.850	40	.000	-.829	.374	2.398	.733

a: Lilliefors Significance Correction, AVGKTS: Knowledge of Technical Solution, AVGKOS: Knowledge of Organisational Solution, AVGBV: Knowledge of Business Value

The skewness and kurtosis measures should be as close to zero as possible. Skewness z-value of AVGKTS is -.666. This skewness z-value is in between -1.96 and 1.96. Kurtosis z-value of AVGKTS is -1.077. This kurtosis z-value is in between -1.96 and 1.96. Since there are only 40 samples, the Shapiro-Wilk test is used. The p-value of AVGKTS is .019 ($P < .05$). H_o is rejected, then data AVGKTS do not assume to be normally distributed.

Skewness z-value of AVGKOS is -3.248. This skewness z-value is out of in between -1.96 and 1.96. Kurtosis z-value of AVGKOS is 2.089. This kurtosis z-value is out of in between -1.96 and 1.96. Since there are only 40 samples, the Shapiro-Wilk test is used. The p-value of AVGKTS is .000 ($P < .05$). H_o is rejected, then data AVGKOS do not assume to be normally distributed.

Skewness z-value of AVGKBV is -2.217. This skewness z-value is out of in between -1.96 and 1.96. Kurtosis z-value of AVGKBV is 3.271. This kurtosis z-value is out of in

between -1.96 and 1.96. Since there are only 40 samples, the Shapiro-Wilk test is used. The p-value of AVGKTS is .000 ($P < .05$). H_o is rejected, then data AVGKBV do not assume to be normally distributed.

Inspection of the shape of the histogram provides information about the distribution of scores on the continuous variables. In fact, the statistics show the variables are normally distributed (shape of the normal curve), which most of the scores occurring in the centre, tapering out towards the extremes. Figure 8, 9 and 10 further confirmed that these data are not normally distributed.

Figure 8: Histogram for Knowledge of Technical Solution Data

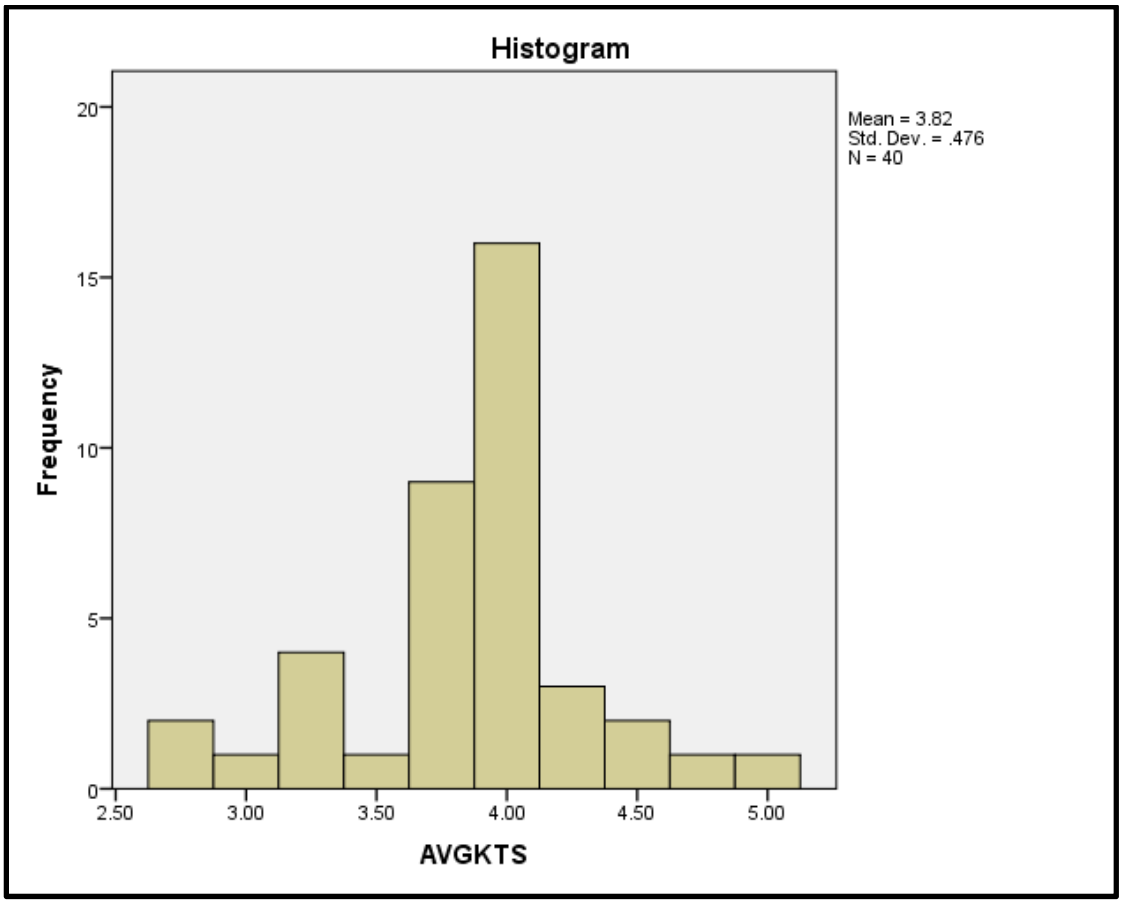


Figure 9: Histogram for Knowledge of Organisational Solution Data

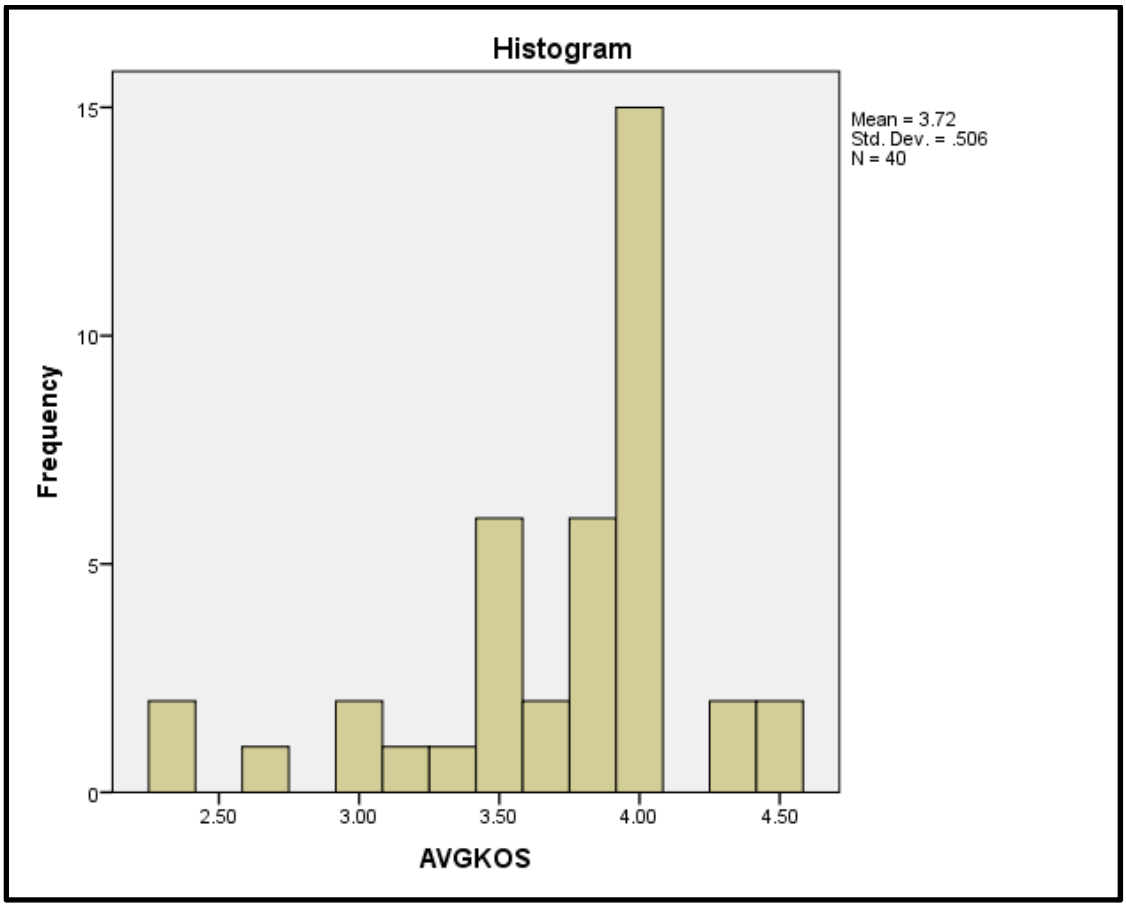
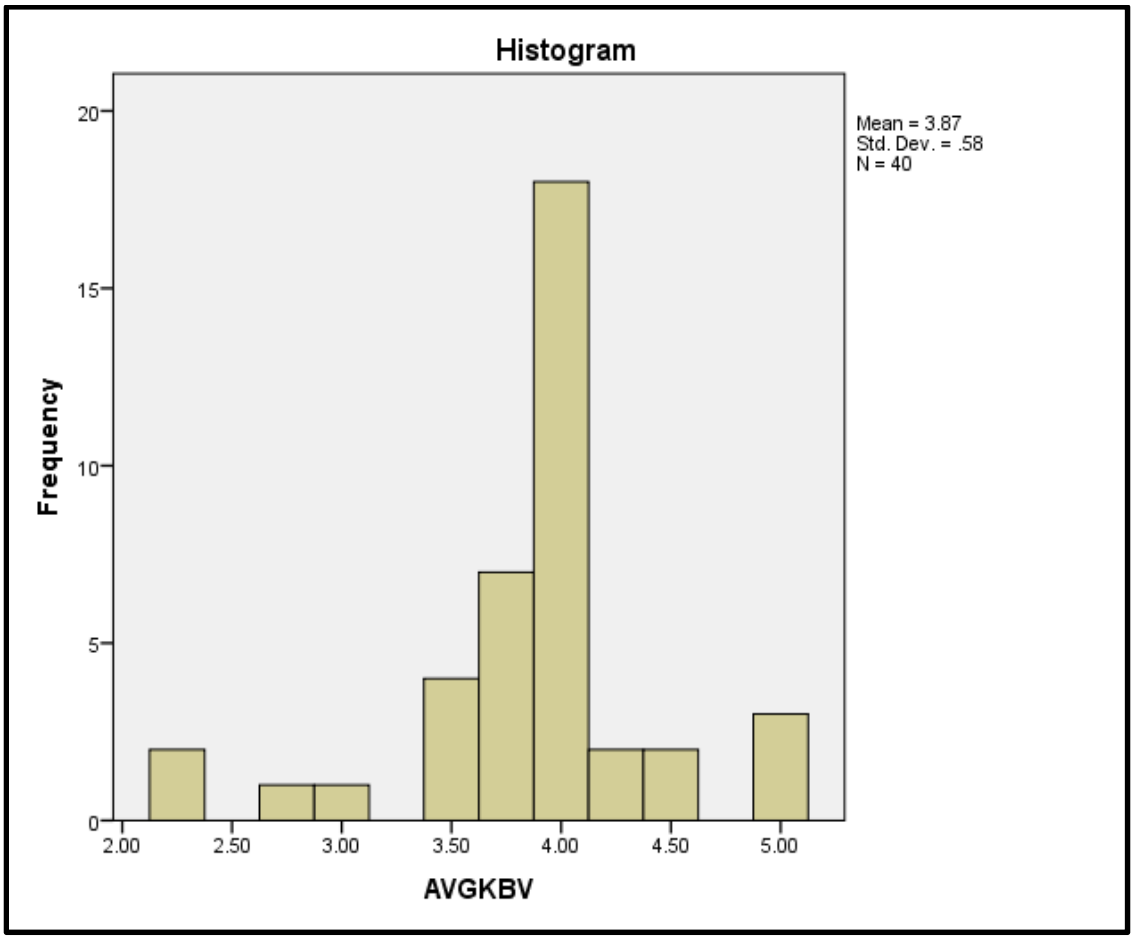


Figure 10: Histogram for Knowledge of Business Value Data



4.3 Bivariate Correlations

Bivariate correlations test on the relationship between independent variables and dependent variables from conceptual framework. The research hypotheses below will answer to the research questions and it would be discussed in chapter 5.

H1a) There is a significant relationship between knowledge of technical solution and scope of work in project management.

Table 11: Descriptive Statistics for Knowledge of Technical Solution and Scope of Work in Project Management

	Mean	Std. Deviation	N
AVGKTS	3.8156	.47619	40
PMSW	1.8500	.36162	40

Table 12: Correlations between Knowledge of Technical Solution and Scope of Work in Project Management

		AVGKTS	PMSW
AVGKTS	Pearson Correlation	1	-.202
	Sig. (2-tailed)		.211
	N	40	40
PMSW	Pearson Correlation	-.202	1
	Sig. (2-tailed)	.211	
	N	40	40

There are 40 samples in this study. The relationship between knowledge of technical solution (as measured by the AVGKTS) and scope of work in project management (as measured by the PMSW) was investigated using Pearson product-moment correlation coefficient (r-value). The r-value of -.202 indicates the weak negative correlation between knowledge of technical solution and scope of work in project management. The

p-value is .211, which is more than .05. That is not significant relationship between knowledge of technical solution and scope of work in project management.

H1b) There is a significant relationship between knowledge of technical solution and quality of the project.

Table 13: Descriptive Statistics for Knowledge of Technical Solution and Quality of the Project

	Mean	Std. Deviation	N
AVGKTS	3.8156	.47619	40
PMQ	1.9250	.26675	40

Table 14: Correlations between Knowledge of Technical Solution and Quality of the Project

		AVGKTS	PMQ
AVGKTS	Pearson Correlation	1	-.238
	Sig. (2-tailed)		.139
	N	40	40
PMQ	Pearson Correlation	-.238	1
	Sig. (2-tailed)	.139	
	N	40	40

There are 40 samples in this study. The relationship between knowledge of technical solution (as measured by the AVGKTS) and quality of the project (as measured by the PMQ) was investigated using Pearson product-moment correlation coefficient (r-value). The r-value of -.238 indicates the weak negative correlation between knowledge of technical solution and quality of the project. The p-value is .139, which is more than .05. That is not significant relationship between knowledge of technical solution and quality of the project.

H1c) There is a significant relationship between knowledge of technical solution and controlling cost of the project.

Table 15: Descriptive Statistics for Knowledge of Technical Solution and Controlling Cost of the Project

	Mean	Std. Deviation	N
AVGKTS	3.8156	.47619	40
PMC	1.7000	.46410	40

Table 16: Correlations between Knowledge of Technical Solution and Controlling Cost of the Project

		AVGKTS	PMC
AVGKTS	Pearson Correlation	1	.178
	Sig. (2-tailed)		.271
	N	40	40
PMC	Pearson Correlation	.178	1
	Sig. (2-tailed)	.271	
	N	40	40

There are 40 samples in this study. The relationship between knowledge of technical solution (as measured by the AVGKTS) and controlling cost of the project (as measured by the PMC) was investigated using Pearson product-moment correlation coefficient (r-value). The r-value of .178 indicates the weak positive correlation between knowledge of technical solution and controlling cost of the project. The p-value is .271, which is more than .05. That is not significant relationship between Knowledge of technical solution and controlling cost of the project.

H1d) There is a significant relationship between knowledge of technical solution and project schedule control.

Table 17: Descriptive Statistics for Knowledge of Technical Solution and Project Schedule Control

	Mean	Std. Deviation	N
AVGKTS	3.8156	47619	40
PMPS	1.7750	.42290	40

Table 18: Correlations between Knowledge of Technical Solution and Project Schedule Control

		AVGKTS	PMPS
AVGKTS	Pearson Correlation	1	-.084
	Sig. (2-tailed)		.607
	N	40	40
PMPS	Pearson Correlation	-.084	1
	Sig. (2-tailed)	.607	
	N	40	40

There are 40 samples in this study. The relationship between knowledge of technical solution (as measured by the AVGKTS) and project schedule control (as measured by the PMPS) was investigated using Pearson product-moment correlation coefficient (r-value). The r-value of -.084 indicates the weak negative correlation between knowledge of technical solution and project schedule control. The p-value is .607, which is more than .05. That is not significant relationship between knowledge of technical solution and project schedule control.

H2a) There is a significant relationship between knowledge of organisational solution and scope of work in project management.

Table 19: Descriptive Statistics for Knowledge of Organisational Solution and Scope of Work in Project Management

	Mean	Std. Deviation	N
AVGKOS	3.7208	.50551	40
PMSW	1.8500	.36162	40

Table 20: Correlations between Knowledge of Organisational Solution and Scope of Work in Project Management

		AVGKOS	PMSW
AVGKOS	Pearson Correlation	1	.373*
	Sig. (2-tailed)		.018
	N	40	40
PMSW	Pearson Correlation	.373*	1
	Sig. (2-tailed)	.018	
	N	40	40

* Correlation is significant at the 0.05 level (2-tailed)

There are 40 samples in this study. The knowledge of organisational Solution helps to explain nearly 13.9 percent of the variance in respondents' scores on the success of scope of work control in project management. The relationship between knowledge of organisational solution (as measured by the AVGKOS) and scope of work in project management (as measured by the PMSW) was investigated using Pearson product-moment correlation coefficient. The r-value of .373 indicates the medium strength positive correlation between knowledge of organisational solution and scope of work in project management. The more organisational knowledge among project team, the greater success of scope of work control in project management. The p-value is .018, which is less than .05. That is significant relationship between knowledge of organisational solution and scope of work in project management.

H2b) There is a significant relationship between knowledge of organisational solution and quality of the project.

Table 21: Descriptive Statistics for Knowledge of Organisational Solution and Quality of the Project

	Mean	Std. Deviation	N
AVGKOS	3.7208	.50551	40
PMQ	1.9250	.26675	40

Table 22: Correlations between Knowledge of Organisational Solution and Quality of the Project

		AVGKOS	PMQ
AVGKOS	Pearson Correlation	1	.063
	Sig. (2-tailed)		.701
	N	40	40
PMQ	Pearson Correlation	.063	1
	Sig. (2-tailed)	.701	
	N	40	40

There are 40 samples in this study. The relationship between knowledge of organisational solution (as measured by the AVGKOS) and quality of the project (as measured by the PMQ) was investigated using Pearson product-moment correlation coefficient (r-value). The r-value of .063 indicates weak positive correlation between knowledge of organisational solution and quality of the project. The p-value is .701, which is more than .05. That is not significant relationship between knowledge of organisational solution and quality of the project.

H2c) There is a significant relationship between knowledge of organisational solution and controlling cost of the project.

Table 23: Descriptive Statistics for Knowledge of Organisational Solution and Controlling Cost of the Project

	Mean	Std. Deviation	N
AVGKOS	3.7208	.50551	40
PMC	1.7000	.46410	40

Table 24: Correlations between Knowledge of Organisational Solution and Controlling Cost of the Project

		AVGKOS	PMC
AVGKOS	Pearson Correlation	1	.362*
	Sig. (2-tailed)		.022
	N	40	40
PMC	Pearson Correlation	.362*	1
	Sig. (2-tailed)	.022	
	N	40	40

* Correlation is significant at the 0.05 level (2-tailed)

There are 40 samples in this study. The knowledge of organisational solution helps to explain nearly 13.1 percent of the variance in respondents' scores on the success in controlling cost of the project. The relationship between knowledge of organisational solution (as measured by the AVGKOS) and controlling cost of the project (as measured by the PMC) was investigated using Pearson product-moment correlation coefficient. The r-value of .362 indicates the medium strength positive correlation between knowledge of organisational solution and controlling cost of the project. The more organisational knowledge among project team, the greater success of project management in budget control. The p-value is .022, which is less than .05. That is significant relationship between knowledge of organisational solution and controlling cost of the project.

H2d) There is a significant relationship between knowledge of organisational solution and project schedule control.

Table 25: Descriptive Statistics for Knowledge of Organisational Solution and Project Schedule Control

	Mean	Std. Deviation	N
AVGKOS	3.7208	.50551	40
PMPS	1.7750	.42290	40

Table 26: Correlations between Knowledge of Organisational Solution and Project Schedule Control

		AVGKOS	PMPS
AVGKOS	Pearson Correlation	1	.358*
	Sig. (2-tailed)		.023
	N	40	40
PMPS	Pearson Correlation	.358*	1
	Sig. (2-tailed)	.023	
	N	40	40

* Correlation is significant at the 0.05 level (2-tailed)

There are 40 samples in this study. The knowledge of organisational solution helps to explain nearly 12.8 percent of the variance in respondents' scores on the success of project schedule control. The relationship between knowledge of organisational solution (as measured by the AVGKOS) and project schedule control (as measured by the PMPS) was investigated using Pearson product-moment correlation coefficient. The r-value of .358 indicates the medium strength positive correlation between knowledge of organisational solution and project schedule control. The more organisational knowledge among project team, the greater success of project management in project schedule control. The p-value is .023, which is less than .05. That is significant relationship between knowledge of organisational solution and project management in project schedule control.

H3a) There is a significant relationship between knowledge of business value and scope of work in project management.

Table 27: Descriptive Statistics for Knowledge of Business Value and Scope of Work in Project Management

	Mean	Std. Deviation	N
AVGKBV	3.8750	.58012	40
PMSW	1.8500	.36162	40

Table 28: Correlations between Knowledge of Business Value and Scope of Work in Project Management

		AVGKBV	PMSW
AVGKBV	Pearson Correlation	1	.581**
	Sig. (2-tailed)		.000
	N	40	40
PMSW	Pearson Correlation	.581**	1
	Sig. (2-tailed)	.000	
	N	40	40

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

There are 40 samples in this study. The knowledge of business value helps to explain nearly 33.8 percent of the variance in respondents' scores on the success of scope of work in project management. The relationship between knowledge of business value (as measured by the AVGKBV) and scope of work in project management (as measured by the PMSW) was investigated using Pearson product-moment correlation coefficient. The r-value of .581 indicates the high strength positive correlation between knowledge of business value and scope of work in project management. The more business value knowledge among project team, the greater success of scope of work in project management. The p-value is .000, which is less than .05. That is significant relationship between knowledge of business value and scope of work in project management.

H3b) There is a significant relationship between knowledge of business value and quality of the project.

Table 29: Descriptive Statistics for Knowledge of Business Value and Quality of the Project

	Mean	Std. Deviation	N
AVGKBV	3.8750	.58012	40
PMQ	1.9250	.26675	40

Table 30: Correlations between Knowledge of Business Value and Quality of the Project

		AVGKBV	PMQ
AVGKBV	Pearson Correlation	1	.104
	Sig. (2-tailed)		.525
	N	40	40
PMQ	Pearson Correlation	.104	1
	Sig. (2-tailed)	.525	
	N	40	40

There are 40 samples in this study. The relationship between knowledge of business value (as measured by the AVGKBV) and quality of the project (as measured by the PMQ) was investigated using Pearson product-moment correlation coefficient (r-value). The r-value of .104 indicates the weak positive correlation between knowledge of business value and quality of the project. The p-value is .525, which is more than .05. That is not significant relationship between knowledge of business value and quality of the project.

H3c) There is a significant relationship between knowledge of business value and controlling cost of project.

Table 31: Descriptive Statistics for Knowledge of Business Value and Controlling Cost of Project

	Mean	Std. Deviation	N
AVGKBV	3.8750	.58012	40
PMC	1.7000	.46410	40

Table 32: Correlations between Knowledge of Business Value and Controlling Cost of Project

		AVGKBV	PMC
AVGKBV	Pearson Correlation	1	.357*
	Sig. (2-tailed)		.024
	N	40	40
PMC	Pearson Correlation	.357*	1
	Sig. (2-tailed)	.024	
	N	40	40

* Correlation is significant at the 0.05 level (2-tailed)

There are 40 samples in this study. The knowledge of business value helps to explain nearly 12.7 percent of the variance in respondents' scores on the success of controlling cost of project. The relationship between knowledge of business value (as measured by the AVGKBV) and controlling cost of the project (as measured by the PMC) was investigated using Pearson product-moment correlation coefficient. The r-value of .357 indicates the medium strength positive correlation between knowledge of business value and controlling cost of the project. The more business value knowledge among project team, the greater success of project management in budget control. The p-value is .024, which is less than .05. That is significant relationship between knowledge of business value and controlling cost of the project.

H3d) There is a significant relationship between knowledge of business value and project schedule control.

Table 33: Descriptive Statistics for Knowledge of Business Value and Project Schedule Control

	Mean	Std. Deviation	N
AVGKBV	3.8750	.58012	40
PMPS	1.7750	.42290	40

Table 34: Correlations between Knowledge of Business Value and Project Schedule Control

		AVGKBV	PMPS
AVGKBV	Pearson Correlation	1	.379*
	Sig. (2-tailed)		.016
	N	40	40
PMPS	Pearson Correlation	.379*	1
	Sig. (2-tailed)	.016	
	N	40	40

* Correlation is significant at the 0.05 level (2-tailed)

There are 40 samples in this study. The knowledge of business value helps to explain nearly 14.4 percent of the variance in respondents' scores on the success of project schedule control. The relationship between knowledge of business value (as measured by the AVGKBV) and project schedule control (as measured by the PMPS) was investigated using Pearson product-moment correlation coefficient. The r-value of .379 indicates the medium strength positive correlation between knowledge of business value and project schedule control. The more business value knowledge among project team, the greater success of project schedule control. The p-value is .016, which is less than .05. That is significant relationship between knowledge of business value and project schedule control.

Figure 11: Summary of Hypotheses Test

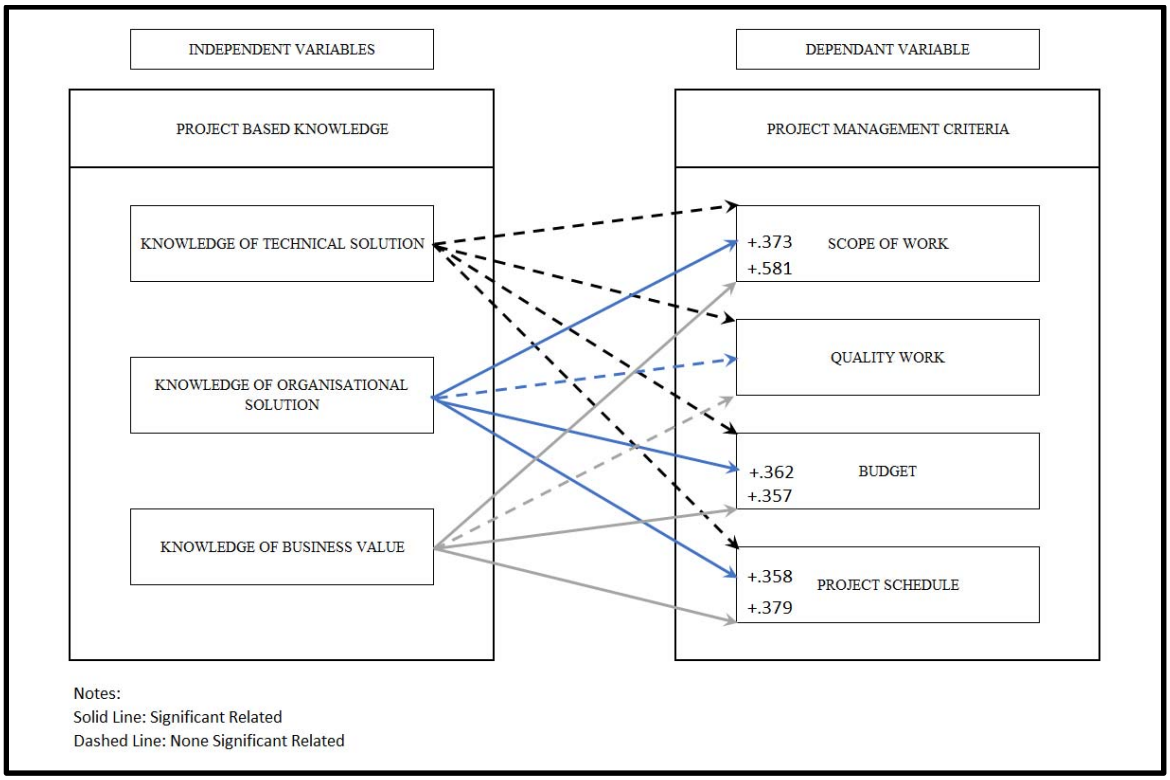


Table 35: Summary of Hypotheses Test

Item	Hypotheses	Result
H1a	There is a significant relationship between knowledge of technical solution and scope of work in project management.	Not Significant
H1b	There is a significant relationship between knowledge of technical solution and quality of the project.	Not Significant
H1c	There is a significant relationship between knowledge of technical solution and controlling cost of project.	Not Significant
H1d	There is a significant relationship between knowledge of technical solution and project schedule control.	Not Significant
H2a	There is a significant relationship between knowledge of organisational solution and scope of work in project management.	Significant
H2b	There is a significant relationship between knowledge of organisational solution and quality of the project.	Not Significant
H2c	There is a significant relationship between knowledge of organisational solution and controlling cost of project.	Significant
H2d	There is a significant relationship between knowledge of organisational solution and project schedule control.	Significant
H3a	There is a significant relationship between knowledge of business value and scope of work in project management.	Significant
H3b	There is a significant relationship between knowledge of business value and quality of the project.	Not Significant
H3c	There is a significant relationship between knowledge of business value and controlling cost of project.	Significant
H3d	There is a significant relationship between knowledge of business value and project schedule control.	Significant

4.4 Results for Project Management

Table 36 summarises that there are 85% of respondents agree that project team has ability to manage scope of work control. Besides that, 92.5% of respondents able to control quality of the project. Additionally, 77.5% of respondents show their ability to control project schedule. However, the lowest percentage of 70% respondents indicate their ability to control cost of the project.

Table 36: Respondents Feedback on Ability to Management

Project Management Success Criteria	Respondent Agree on Ability to Manage		Respondent Disagree on Ability to Manage	
	Frequency	Percentage	Frequency	Percentage
Scope of Work Control	34	85.0	6	15.0
Control on the Quality of the Project	37	92.5	3	7.5
Control on the Cost of the Project	28	70.0	12	30.0
Control on the Project Schedule	31	77.5	9	22.5

4.5 Linear Regression Results

Table 37: Model Summary of Scope of Work Control as a Dependent Variable

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.704[a]	.495	.453	.26741

a. Predictors (Constant), AVGKBV, AVGKTS, AVGKOS

Model summary from linear regression expands as following:

- R, Multiple correlation coefficient = .704 (Indicates good prediction level)
- R square, coefficient of determination = .495

- This means 49.5% of the independent variables explains the variability of dependent variable.

Table 38: ANOVA of Scope of Work Control as a Dependent Variable

Model		Sum of Squares	df	Mean Square	F	Sig
1	Regression	2.526	3	.842	11.774	.000[b]
	Residual	2.574	36	.072		
	Total	5.100	39			

b. Predictors: (Constant), AVGKBV, AVGKTS, AVGKOS

F-ratio shows whether the overall regression is a good fit for the data. The significant level of .000 revealed that the independent variables is statistically significant in predicting the dependent variable, $F(3, 36) = 11.774$, $p < .05$. Therefore, the regression model is a good fit of the data. In other words, knowledge of technical solution, knowledge of organisational solution and knowledge business value are able to predict scope of work in project management significantly.

Table 39: Coefficients of Scope of Work Control as a Dependent Variable

Model		Unstandardised Coefficients		Standardised Coefficients	t	Sig.	95.0% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	1.288	.418		3.082	.004	.440	2.135
	AVGKTS	-.320	.095	-.421	-3.359	.002	-.513	-.127
	AVGKOS	.048	.112	.067	.430	.670	-.179	.276
	AVGKBV	.414	.098	.663	4.224	.000	.215	.612

Coefficient table descripts the following information:

- For every degree of increment of scope of work control, there will be decreasing of .421 degree of knowledge of technical solution.
- For every degree of increment of scope of work control, there will be increasing of .067 degree of knowledge of organisational value.
- For every degree of increment of scope of work control, there will be increasing of .663 degree of knowledge of business value.

- If $p < .05$, meaning there is a statistically significant coefficient between the two variables.

A multiple regression analysis was conducted to predict scope of work control from knowledge of technical solution, knowledge of organisational solution and knowledge of business value. It was found that knowledge of technical solution and knowledge of business value statistical significantly predicted scope of work control, $F(3, 36) = 11.774$, $p < .05$, $R^2 = .495$. However, knowledge of organisational solution was not significant in predicting scope of work control with $p > .05$ (significant level of .670).

Table 40: Model Summary of Quality Control as a Dependent Variable

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.302[a]	.091	.016	.26466

a. Predictors (Constant), AVGKBV, AVGKTS, AVGKOS

Model summary from linear regression expands as following:

- R, Multiple correlation coefficient = .302
- R square, coefficient of determination = .091
- This means 9.1% of the independent variables explains the variability of dependent variable.

Table 41: ANOVA of Quality Control as a Dependent Variable

Model		Sum of Squares	df	Mean Square	F	Sig
1	Regression	.253	3	.084	1.206	.322[b]
	Residual	2.522	36	.070		
	Total	2.775	39			

b. Predictors: (Constant), AVGKBV, AVGKTS, AVGKOS

F-ratio shows whether the overall regression is a good fit for the data. The significant level of .322 revealed that the independent variables does not statistically significant in predicting the dependent variable, $F(3, 36) = 1.206$, $p > .05$. In other words, knowledge

of technical solution, knowledge of organisational solution and knowledge business value are unable to predict quality control in project management significantly.

Table 42: Coefficients of Quality Control as a Dependent Variable

Model		Unstandardised Coefficients		Standardised Coefficients	t	Sig.	95.0% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	2.186	.414		5.286	.000	1.348	3.025
	AVGKTS	-.168	.094	-.300	-1.786	.082	-.359	.203
	AVGKOS	.023	.111	.044	.208	.837	-.202	.248
	AVGKBV	.076	.097	.165	.785	.437	-.120	.273

Coefficient table descripts the following information:

- For every degree of increment of quality control, there will be decreasing of .300 degree of knowledge of technical solution.
- For every degree of increment of quality control, there will be increasing of .044 degree of knowledge of organisational value.
- For every degree of increment of quality control, there will be increasing of .165 degree of knowledge of business value.
- If $p < .05$, meaning there is a statistically significant coefficient between the two variables.

A multiple regression analysis was conducted to predict quality control from knowledge of technical solution, knowledge of organisational solution and knowledge of business value. It was found that these variables did not statistical significantly predicted quality control, $F(3, 36) = 1.206$, $p > .05$, $R^2 = .091$.

Table 43: Model Summary of Cost Control as a Dependent Variable

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.400[a]	.160	.090	.44273

a. Predictors (Constant), AVGKBV, AVGKTS, AVGKOS

Model summary from linear regression expands as following:

- R, Multiple correlation coefficient = .400
- R square, coefficient of determination = .160
- This means 16% of the independent variables explains the variability of dependent variable.

Table 44: ANOVA of Cost Control as a Dependent Variable

Model		Sum of Squares	df	Mean Square	F	Sig
1	Regression	1.344	3	.448	2.285	.095[b]
	Residual	7.056	36	.196		
	Total	8.400	39			

b. Predictors: (Constant), AVGKBV, AVGKTS, AVGKOS

F-ratio shows whether the overall regression is a good fit for the data. The significant level of .095 revealed that the independent variables does not statistically significant in predicting the dependent variable, $F(3, 36) = 2.285$, $p > .05$. In other words, knowledge of technical solution, knowledge of organisational solution and knowledge business value are unable to predict cost control in project management significantly.

Table 45: Coefficients of Cost Control as a Dependent Variable

Model		Unstandardised Coefficients		Standardised Coefficients	t	Sig.	95.0% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	.135	.692		.195	.847	-1.268	1.538
	AVGKTS	.053	.158	.055	.338	.738	-.266	.373
	AVGKOS	.199	.186	.217	1.072	.291	-.177	.575
	AVGKBV	.160	.162	.201	.990	.329	-.168	.489

Coefficient table descripts the following information:

- For every degree of increment of cost control, there will be increasing of .055 degree of knowledge of technical solution.
- For every degree of increment of cost control, there will be increasing of .217 degree of knowledge of organisational value.

- For every degree of increment of cost control, there will be increasing of .201 degree of knowledge of business value.
- If $p < .05$, meaning there is a statistically significant coefficient between the two variables.

A multiple regression analysis was conducted to predict cost control from knowledge of technical solution, knowledge of organisational solution and knowledge of business value. It was found that these variables did not statistical significantly predicted cost control, $F(3, 36) = 2.285$, $p > .05$, $R^2 = .160$.

Table 46: Model Summary of Project Schedule Control as a Dependent Variable

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.467[a]	.218	.153	.38916

a. Predictors (Constant), AVGKBV, AVGKTS, AVGKOS

Model summary from linear regression expands as following:

- R, Multiple correlation coefficient = .467
- R square, coefficient of determination = .218
- This means 21.8% of the independent variables explains the variability of dependent variable.

Table 47: ANOVA of Project Schedule Control as a Dependent Variable

Model		Sum of Squares	df	Mean Square	F	Sig
1	Regression	1.523	3	.508	3.352	.029[b]
	Residual	5.452	36	.151		
	Total	6.975	39			

b. Predictors: (Constant), AVGKBV, AVGKTS, AVGKOS

F-ratio shows whether the overall regression is a good fit for the data. The significant level of .029 revealed that the independent variables is statistically significant in predicting the dependent variable, $F(3, 36) = 3.352$, $p < .05$. Therefore, the regression

model is a good fit of the data. In other words, knowledge of technical solution, knowledge of organisational solution and knowledge business value are able to predict project schedule control in project management significantly.

Table 48: Coefficients of Project Schedule Control as a Dependent Variable

Model		Unstandardised Coefficients		Standardised Coefficients	t	Sig.	95.0% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	1.018	.608		1.675	.103	-.215	2.253
	AVGKTS	-.216	.138	-.243	-1.559	.128	-.497	.065
	AVGKOS	.198	.163	.236	1.211	.234	-.133	.528
	AVGKBV	.218	.142	.299	1.530	.135	-.071	.507

Coefficient table descripts the following information:

- For every degree of increment of project schedule control, there will be decreasing of .243 degree of knowledge of technical solution.
- For every degree of increment of project schedule control, there will be increasing of .236 degree of knowledge of organisational value.
- For every degree of increment of project schedule control, there will be increasing of .299 degree of knowledge of business value.
- If $p < .05$, meaning there is a statistically significant coefficient between the two variables.

A multiple regression analysis was conducted to predict cost control from knowledge of technical solution, knowledge of organisational solution and knowledge of business value. It was found that these variables did not statistical significantly predicted project schedule control, $F(3, 36) = 3.352$, $p > .05$, $R^2 = .218$.

4.6 Failure Factor Results

There are survey on the factor of failure on project management. Even though these are minority response. However, these factors of failure on project management, which shown in table 49, need to be carefully analyse from the respondent in order to improve project management. Many respondents agree that project team did not clearly understand on the delivery scope is the main factor of failure in scope of work control. Miscommunication between project team and procurement team is the second highest ranking of failure factor. Besides that the factors follow by "mistake in proposal", "undocumented in minute of meeting", "misunderstanding during the design" located in the ranking or third, fourth, and fifth respectively. The last three factors will be "unclear documented in minutes of meeting", "unclear quotation to clients", and "insufficient of information from client during preliminary stage" respectively.

Table 49: Failure Factors on Scope of Work Control

Failure Factors	**Weightage**	**Ranking**
Misunderstanding during the design	4	5
Insufficient of information from client during preliminary stage	1	8
Unclear quotation to clients	2	7
Mistake in proposal	6	3
Unclear documented in minutes of meeting	3	6
Undocumented in minute of meeting	5	4
Miscommunication between project team and procurement team	7	2
Project team did not clearly understand on the deliverable scope	8	1

In order to understand the factor of failure on project quality control, the feedback from respondents can be considered as shown in table 50. The main factor will be miscommunication between project team and procurement team. At second highest ranking of factor is cutting corner in design and it follows by tolerance of QA/QC team and unqualified suppliers or sub-contractors. The least impact factor will be tolerance of project team.

Table 50: Failure Factors on Controlling the Quality of Project

Failure Factors	Weightage	Ranking
Tolerance of project team	1	5
Unqualified suppliers or sub-contractors	2	4
Tolerance of QA/QC team	3	3
Cutting corner in design	4	2
Miscommunication between project team and procurement team	5	1

Table 51 tabulated the ranking of failure factors on project cost control. Majority of respondents highlighted the delay in project period would be the main factor. The second ranking to be blamed on procurement team do not source for more suppliers. The third ranking belong to the factor of unable to get competitive price from supplier due to frequent delay in payment. Fourth and fifth failure factor would be less of suppliers contacts and unhealthy in vendor system respectively. The last two factors would be project manager unable to control the expenses within project team and under quote during proposal stage.

Table 51: Failure Factors on Controlling the Cost of the Project

Failure Factors	Weightage	Ranking
Under quote during proposal stage	1	7
Project manager unable to control the expenses within project team	2	6
Unhealthy in vendor system	3	5
Less of suppliers contacts	4	4
Unable to get competitive price from supplier due to frequent delay in payment	5	3
Procurement team do not source for more suppliers	6	2
Delay in project period	7	1

There are twelve failure factors on project schedule control as listed in table 52. Most of the respondents highlighted that "project manager did not track closely on the project progress" is the key factor of the delay of the project. Another significant factor of failure would be additional jobs scope to be added during project progress. Miscommunication between project team and procurement team is another roof factor of

the failure in controlling the project schedule. "Long procedure in giving approval from client", "delay in approval from authorities", "design team took longer time in design", and "long procedure in purchasing" would be the fourth, fifth, sixth and seventh ranking factor respectively. It follows by the factor of project team spends a longer time to source for purchased products and the project manager unable to dedicate tasks effectively. The less critical factors will be "the project manager unable to effectively resolve issues", "the project manager unable to effectively communicate with other parties", and "uncertainty on the purchased product lead time".

Table 52: Failure Factors on Controlling the Project Schedule

Failure Factors	**Weightage**	**Ranking**
Uncertainty on the purchased product lead time	1	12
The project manager unable to effectively communicate with other parties	2	11
The project manager unable to effectively resolve issues	3	10
The project manager unable to dedicate tasks effectively	4	9
Project team spends a longer time to source for purchased products	5	8
Long procedure in purchasing	6	7
Design team took longer time in design	7	6
Delay in approval from authorities	8	5
Long procedure in giving approval from client	9	4
Miscommunication between project team and procurement team	10	3
Additional jobs scope to be added during project progress	11	2
Project manager did not track closely on the project progress	12	1

CHAPTER 5

DISCUSSION AND CONCLUSION

Chapter 5 discusses the findings in terms of research questions and corresponding hypotheses and a summary of research contributions of this research. It discusses the limitations of the research project based on research design considerations. Then proposes a detailed scope of research in the future.

5.1 Discussion

This research applies to determine if there is a relationship between project-based knowledge and project management success criteria. The research focuses on the knowledge management practices in use in project-based organisations in order to improve project management applications. This study provide the contribution of knowledge management towards project management. A desired output of the research is to encourage the implementation of knowledge management practice in project-based organisations and benefit to project stakeholders, such as project clients, project team members, authorities and societies.

The conclusions for this research were based on 95% or greater confidence level due to the sample size and the anticipated response rate. In total, there were 40 respondents to the survey questionnaire. The thoughtfulness of the respondents towards the purpose of the study is proven by the number of responses to the survey questions as shown in Chapter 4, Research Results, where the number of responses is greater than the

statistically acceptable n more than 30 (Lierni, 2004). When n more than 30, the sampling distribution of the β is approximately normal. (Lierni, 2004)

Based on the responses from this survey, majority of respondents are young project team members, which 47.5% respondents from the age group from 21 year old to 30 year old. They feel comfortable to undertake this survey. From the prospective of proactively participated in the survey, they may have more time and care about taking advantage of an opportunity to make their own contribution to the knowledge base of project management by sharing their own experience with using knowledge sharing and project management in their own projects.

Among a project team, project engineer is majority in a team, therefore, more project engineers participated in this research survey. Then followed by project manager. The rest of project team members are tender engineer, project executive, project sales personnel and top management of project-based organisations. This research has taken samples from varies industries of project-based organisations, including automotive, construction, electrical and instrumentation, Environment, power, and oil and gas. Majority respondents came from construction industry. This is justified that Malaysia is undergoing a development stage, construction industry is actively grown in current situation. Besides that, environmental industry is required for environmental assessment and provide environmental facilities. Therefore, environmental industry respondents were the second largest group of respondents.

Research Question a:

What are the contribution of knowledge management towards project management?

The results of the contribution was summarised in figure 11 of chapter 4.4, the hypotheses tested by using bivariate correlation test. Result showed that none of knowledge of technical solution contributes to the project management success. Even though technical knowledge may be essential to project management success, but research showed that it does not significant to project management success. According to Langer et al, tacit knowledge of organisational culture and clients are the most significant contribution to project management. This soft skill will indirectly improve to the project

management via complexity coordination with client especially while dealing with less familiarity project.

There is significant relationship between knowledge of organisational solution and scope of work control. Organisational solution knowledge includes skills changes and culture changes give support to project team to control the scope of work. This knowledge should cooperate among organisation. Understanding operation of each department. This cooperation should include project department with sales department and purchasing department. The alliances between there three department will build up a stronger project team, who has better understanding on scope of work to be offered. These will be further confirmed the product or services offered can solve client's existing problems.

The scope of work control will be directly impact on cost and project schedule control. Clements et al. (2012) also emphasis that scope of work control will affect to project budget and schedule.

The result of survey also state that there is significant relationship between knowledge of business value and scope of work control. Business value knowledge refers to the understanding of business objectives. This knowledge is important to deliver the most suitable product and services to client. At the very beginning stage, business object must be plant among project team members. They need to share same ultimate goal in order to deliver solution to client. Furthermore, scope of work control will share impact to cost and schedule control.

Research Question b:

How to relate project-based knowledge categories to success project management criteria?

Linear regression test to be used to find out the relationship of the project-based knowledge categories to success project management criteria. Survey result show that the only one model of relationship can be justified. That is scope of work control is negatively related to knowledge of technical solution with the coefficient of .421; and there is positively related to knowledge of business value with the coefficient of .663. These mean the improvement of technical knowledge will reduce the scope of work

control. However, business value knowledge will be improve the scope of work control. Indirectly, the improvement of scope of work control will contribute positive impact to budget and project schedule control. The improvement of technical knowledge may create personal ergo. This scenario can be inference from the response rate of the survey. Majority of respondents are below 30 year old. Egoism among the team will break down the communication among project team members.

Research Question c:

What are the factors of implementation knowledge management in success project?

As known, knowledge management is important to be implemented in order to manage project successively. However, it take time for project team members to understand the appropriate methods to start up the project management in the most effective ways. The knowledge selection and sharing will be a big challenge to implement knowledge management. Project-based organisation need to select and store the useful data in become knowledge database. This require Information Technology (IT) assistance, this is an important for organisations to invest in IT. In order to select and store projects data into a database, contribution of knowledge among the organisational level become an important moves. From the bivariate correlation result of knowledge of organisational solution, it justified that organisational support is a key factor in implementation of knowledge management in project-based organisations. Organisational knowledge should come from the sharing of leadership, training, clear business strategy, sharing of business goal, department collaboration. There are very difficult for different segment of team members to share their knowledge to all project team members in an organisation. Different segment of staffs in an organisation do not often meet and talk together, and there are communication barrier across the department or within the department. Therefore, encoding and decoding of knowledge for every level of staffs become a key media to contribute their knowledge. The role of leadership is important to be planted in every level of staffs. Every level of staffs should have initiated to share their knowledge to other colleagues. Other than knowledge sharing, training is required to equip staffs. Lack of knowledge will cause the failure in identifying knowledge. Project team members do not know what to do in sorting the knowledge data and how to apply the existing knowledge.

Research Question d:

What are the difficulties of execution knowledge management in engineering companies?

Based on the feedback collected, the main difficulty of executing knowledge management is human related challenge (Ou & Davison). They may be busy with pile of works until they ignore the impact of knowledge sharing. As junior workers expressed the willingness to knowledge sharing. However, junior workers lack of knowledge to be shared. Therefore, knowledge management implementation difficulty should be studied through creation of explicit knowledge, knowledge storage, transfer and application. This result has been supported by the research from Ou & Davison, this report shows that the difficulty of knowledge management can be classified into three aspects, such as structural related causes, human related causes and technical related causes (Ou & Davison). Most of the organisations do not create the culture to encourage knowledge creation and sharing. The organisation does not provide knowledge management system properly. It takes time for junior project team members to catch up best practices. Senior staffs may not be willing to share their knowledge and problem solving skill. They may afraid of losing competitive in the organisation after sharing their knowledge. Ou and Davison also mentioned that the personal relationship (guanxi) is a factor obstacle of knowledge sharing. The IT system on knowledge management does not facilitate the movement of knowledge management practices. Some organisations are still using the non-usefulness of knowledge management systems.

5.2 Research Implication

Knowledge management need to be properly planned to be executed in organisation. As known, knowledge creation is the most initial stage to implement knowledge management. A success factor in knowledge management practice must be focus on how an organisation creates internal communications among different departments in order to strengthen organisational knowledge base. The recognition of internal communications

across department are necessary. In fact, communication encoding and decoding will become a future study area. The effective of communication among the organisation will be the success factor of knowledge management planning. In future, method of encoding and decoding need to be deeply study. It may involve in IT applications. The cross over scope between IT industry and social science research must be encouraged to examine the mechanism of knowledge creation, sharing, transfer and application.

5.3 Limitation of Research

The perception of junior staffs is different from the senior position workers in the understanding of the knowledge management practice within an organisation. This research survey respondents mostly are junior staffs, this may not be able to understand the actual mind set of senior or experienced staffs.

The statistical results in correlation bivariate test shows that most of the relationships are at the weak and medium strength level. These results do not able to provide a comprehensive explanation on relationship between independent variables and dependent variables.

5.4 Recommendations

This research samples collected from 150 project management personnel in engineering organisations. A bigger sample size need to be collected to deliver a comprehensive knowledge management contribution to project-based organisations. A stronger design would use a matched sample of project-based personnel so that the independent and dependent data are collected from bigger group to improve the sample size.

A case study on engineering organisation will be able to narrow down the impact of knowledge management toward project management. The operation knowledge

management in an organisation would affect the finding of the research. Therefore, a combination of survey and interview data collection is required to improve the research findings.

5.5 Conclusion

For a project to be successful, it's not enough simply to manage the project competently, and deliver a good quality product and services. Based on the respondent feedback, project failure mainly caused by human factor. Therefore, to avoid failure, knowledge of organisational solution and knowledge of business value need to be identified and shared among the staffs. Result of survey shows that both knowledge of organisational solution and knowledge of business value are significantly positive relationship with scope of work control, cost control, and project schedule control. Besides that, knowledge of technical solution and knowledge of business value statistical significantly predicted scope of work control, $F(3, 36) = 11.774$. Junior project members are very keen to learn knowledge through knowledge management platform. Project-based organisation can emphases on leadership skill while implement knowledge management among project-based organisation.

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Appendix A

UNIVERSITI TUNKU ABDUL RAHMAN (UTAR)
FACULTY OF ACCOUNTANCY AND MANAGEMENT

Dear Participant,

I am a MBA student in the Faculty of Accountancy and Management (FAM) at Universiti Tunku Abdul Rahman and I am conducting a research of "The Contribution of Knowledge Management to Project Management Performance in Engineering Project-Based Organisations". This research aims to deliver the following objectives:

a) Find out the contribution of knowledge management towards project management

b) Find out the relationship of project based knowledge categories to success project management criteria.

c) The factor of implementation knowledge management in success project

d) The difficulties of execution knowledge management in engineering company

Through your participation, I eventually hope to justify the relationship of knowledge management and project management. This study may provide a clearer picture on implementation of knowledge management in project oriented organisation.

It may take 15 to 20 minutes to look through and complete the questionnaire by followed the given instructions, then click "submit" at the last page of the questionnaire. Participation is strictly voluntary and you may refuse to participate at any time. Your responses will not be identified and your answers will not influence your present or future employment.

Thank you for taking the time to assist me in my educational endeavors. Completion and return of the questionnaire will indicate your willingness to participate in this study. If you require additional information or have questions, please contact me at +6012-808 5980 or at francisnee81@gmail.com. If you have any questions about your rights as a research subject, you may contact the Institute of Postgraduate studies and Research of Universiti Tunku Abdul Rahman (UTAR) by mail at 13 Jalan 13/6, 46200 Petaling Jaya, Selangor Darul Ehsan, or by phone at 603-7958 2628 Ext 8202 / 8204, or by email at ipsr@utar.edu.my

Kindly click on the link to start your survey:
https://www.surveymonkey.com/s/utarmba1105998

Thank you very much.

Sincerely,

Francis Nee

Francis Nee
Master of Business Administration Student
Universiti Tunku Abdul Rahman (UTAR)

SECTION ONE

PERSONAL BACKGROUND

You are invited to participate in a survey which relevant to project management and knowledge management. Any answers you give will remain confidential to the researcher and will be used only for research purposes in academic publications. Your privacy is important.

INSTRUCTION: *Please mark (√) at the relevant spaces next to the question in which the answers that are more applicable for you.*

1. Gender [ ] Male [ ] Female

2. Age _____ years old

3. Race [ ] Malay [ ] Native
[ ] Chinese [ ] Indian
[ ] Other, please specify _____

4. Marital Status [ ] Married [ ] Single
[ ] Divorced [ ] Widowed

5. Education Level [ ] SPM [ ] STPM or Certificate
[ ] Diploma [ ] Degree
[ ] Master [ ] Doctoral
[ ] Others, please specify _____

6. Years of Experience in Project Management _____ years

7. Monthly Income [ ] Less than RM2,000 [ ] RM2,001 – RM3,000
[ ] RM3,001 – RM4,000 [ ] RM4,001 – RM5,000
[ ] RM5,001 – RM7,000 [ ] RM7,001 – RM10,000
[ ] RM10,001 – RM15,000 [ ] More than RM15,001

8. Job Category [ ] Tender Engineer [ ] Project Engineer
[ ] Project Executives [ ] Project Sales Personnel
[ ] Project Manager [ ] Top Management
[ ] Others, please specify _____

9. Company Category [ ] Automotive [ ] Construction
[ ] Electrical & Instrumentation [ ] Environmental
[ ] Power [ ] Oil & Gas

[ ] Others, please specify _____

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SECTION TWO

INSTRUCTION: *Read each question carefully and then circle an answer which you feel reflects your judgment by using the following scale:*

1	2	3	4	5
Strong Disagree	Disagree	Neutral	Agree	Strongly Agree

A KNOWLEDGE OF TECHNICAL SOLUTION

A1.	Project teams create deliverables, including any new information and technical solution learned on the project, which can be used by the firm in the future	1 2 3 4 5
A2.	Ease to search for technical data in the organisation (Does not include internet browsing)	1 2 3 4 5
A3.	The organisation has the ability to provide necessary technical training to those on project that need it	1 2 3 4 5
A4.	Information such as project / subordinate plans and project results that goes into the database is standardized so that project data needed on future projects can be easily retrieved by those that need it	1 2 3 4 5
A5.	The organisation has the ability to capture project data for use during conduct of the project and after the project has been completed	1 2 3 4 5
A6.	The organisation has clearly provided the standard operating procedure of the project management to project team	1 2 3 4 5
A7	There have a standard compilation of databases that are given to all new hires	1 2 3 4 5
A8	The organisation has provided useful technical databases for project team	1 2 3 4 5

NEXT PAGE

B KNOWLEDGE OF ORGANISATIONAL SOLUTION

B1.	The organisation provides the project team with necessary financial resources needed	1 2 3 4 5
B2.	The organisation provided the projects team with necessary people needed	1 2 3 4 5
B3.	The organisation provided the projects team with information needed	1 2 3 4 5
B4.	The organisation provided the projects team with the necessary facilities / workspace / equipment needed	1 2 3 4 5
B5.	The organisation has the ability to define skills and knowledge needed by those implementing the strategy	1 2 3 4 5
B6.	The organisation has the ability to select a project team with the required skills and competencies necessary to execute projects	1 2 3 4 5

C KNOWLEDGE OF BUSINESS VALUE

C1.	The organisation responds to client needs in a timely and effective manner	1 2 3 4 5
C2.	The organisation exhibits a drive for results and deliver what was needed by client	1 2 3 4 5
C3.	The organisation pursues marketing strategies to maintenance the relationship with clients	1 2 3 4 5
C4.	The organisation keep good relationship with suppliers and sub-contractors	1 2 3 4 5

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D PROJECT MANAGEMENT

D1. The organisation has ability to control the scope of work
[ ] Yes (Go to Question D2) [ ] No (Go to Question D1a)

D1a. The changes of scope of work due to (You can rate more than 1 choice):

Rate the applicable factors only, 1 for minor factor and 8 for major factor

[ ] Misunderstanding during the design
[ ] Insufficient of information from client during preliminary stage
[ ] Unclear quotation to clients
[ ] Mistake in proposal
[ ] Unclear documented in minutes of meeting
[ ] Undocumented in minute of meeting
[ ] Miscommunication between project team and procurement team
[ ] Project team did not clearly understand on the deliverable scope

D2. The organisation has ability to control the project schedule
[ ] Yes (Go to Question D3) [ ] No (Go to Question D2a)

D2a. The delay of project due to (You can rate more than 1 choice):

Rate the applicable factors only, 1 for minor factor and 12 for major factor

[ ] Uncertainty on the purchased product lead time
[ ] The project manager unable to effectively communicate with other parties
[ ] The project manager unable to effectively resolve issues
[ ] The project manager unable to dedicate tasks effectively
[ ] Project team spends a longer time to source for purchased products
[ ] Long procedure in purchasing
[ ] Design team took longer time in design
[ ] Delay in approval from authorities
[ ] Long procedure in giving approval from client
[ ] Miscommunication between project team and procurement team
[ ] Additional jobs scope to be added during project progress
[ ] Project manager did not track closely on the project progress

NEXT PAGE

D3. The organisation has ability to control the quality of deliverable products
[ ] Yes (Go to Question D4) [ ] No (Go to Question D3a)

D3a. The failure of controlling the quality due to (You can rate more than 1 choice):

Rate the applicable factors only, 1 for minor factor and 5 for major factor

[ ] Tolerance of project team
[ ] Unqualified suppliers or sub-contractors
[ ] Tolerance of QA/QC team
[ ] Cutting corner in design
[ ] Miscommunication between project team and procurement team

D4. The organisation has ability to control the cost of project
[ ] Yes (The End) [ ] No (Go to Question D4a)

D4a. The failure of controlling the project cost due to (You can rate more than 1 choice):

Rate the applicable factors only, 1 for minor factor and 7 for major factor

[ ] Under quote during proposal stage
[ ] Project manager unable to control the expenses within project team
[ ] Unhealthy in vendor system
[ ] Less of suppliers contacts
[ ] Unable to get competitive price from supplier due to frequent delay in payment
[ ] Procurement team do not source for more suppliers
[ ] Delay in project period

~ Thank you for your time and efforts ~

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