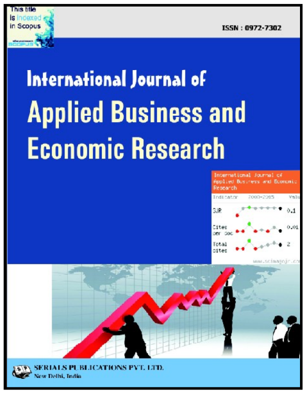

International Journal of Applied Business and Economic Research

ISSN : 0972-7302

available at http: www.serialsjournals.com

Volume 15 • Number 22 (Part-III) • 2017

Project Management Practice and Construction Project's Success: Empirical Evidence from Project Lifecycle's Perspective

Dhanasegaran Ramiah[1], Mudiarasan Kuppusamy[2*] and Behrooz Gharleghi[3]**

[1, 2, 3] *Faculty of Business and Management, Asia Pacific University of Technology and Innovation, Bukit Jalil, 57000, Kuala Lumpur, Malaysia*
[*] *Centre of Business Digitisation and Innovation, corresponding author, E-mail: mudiarasan@apu.edu.my*
[**] *Centre for Socio-Economics of Aging and Development*

Abstract: The research was conducted with the aim of examining the role of project management knowledge assets across different stages of a construction project's success. Using a quantitative research method, primary data were compiled from 370 sample construction firms and analysed using the SEM-PLS analytical technique. The result showed that in order to effectively manage construction projects, the construction firm needs to possess strategic knowledge assets. It was identified that relevant project management assets enhanced the success achieved at every stage of a construction project. Successful construction companies are those which are able to recognise that capturing project management knowledge is important to their competitive advantage. Possessing project management knowledge is vital to effective administration of construction projects, with continuous feedback, alignment of knowledge in the project lifecycle and knowledge sharing among the project team members, being critical for enhancing the success of projects.

Keywords: Project management, knowledge assets, construction firms, Malaysia, SEM-PLS

1. INTRODUCTION

The construction industry builds a nation. This industry fosters the livelihood of the construction ecosystem such as the material producers, transporters, skilled labours and many others (Markstein, 2015; Ofori, 2016; Dubey & Kamat, 2016). Thus the failure of this industry does not augur well at both macro and micro levels. In reality there are reports of numerous construction projects' failures, mainly in terms of delays, off-budget and/or lack of project scope compliance (e.g. Alinaitwe *et al.*, 2013; Kwatsima, 2015). The series of construction projects failures in Malaysia in the past twenty years or remains a concern. Jatarona *et al.* (2015) for example cited a total of 235 "sick" construction projects in 2011 and 191 in 2013. The latest casualty of project delay is the Sri Aman Hospital project in Sarawak (Bong, 2017).

The practical issues experienced by the industry have led to various academic research activities to find out why the problems exist and persist. The researchers found issues such as shoddy workmanship (e.g. Jahanshahi & Brem, 2017; Endut *et al*., 2009; Memon *et al*., 2012; Memon & Rahman, 2014), weak scheduling (e.g., Zin *et al*. 2008; Elias & Ismail, 2012), poor procurement process (e.g., Takim & Adnan, 2008; Jaafar & Radzi, 2013; Chong & Preece, 2014), weak risk management analysis (e.g., Yusuman *et al*., 2008; Adnan *et al*., 2008; Abdul-Rahman, 2016) among the key reasons for failures to occur.

While these studies were able to identify some conceivable problems, it is deemed as incomplete. Existing empirical studies for Malaysia have not examined the role of project management as construction projects' success driving framework. Many practical and scholastic works have recognised the importance of adopting appropriate project management tools to avoid or minimise failures of construction projects (e.g. Polyanainova, 2011; PMI, 2013). The nature of project management as a tool to control, monitor and manage sequence of activities fits well to the nature of construction projects (Archibald & Archibald, 2016). Following such a line of argument, this study aims to examine the influence of project management practice in asserting successful construction projects in Malaysia. In such a pursuit, this study leveraged on two specific phenomenon.

First, we demonstrate the influence of project management practice by merging the notion of project management and knowledge management. Frey *et al*. (2009) debated on the nexus between both dimensions by way of similar characteristics. System, people and tools are components of project management, whereas people, technology and organisational factors are components of knowledge management (Awad and Ghaziri, 2004; Lewis, 2005). As these components are comparable, they can merge and work in conjunction with each other (Polyaninova, 2011).

To this end, we used the Project Management's Body of Knowledge (PMBOK) as the framework infused with both project management and knowledge elements. Introduced by the Project Management Institute (PMI) in early 1983, PMBOK's fifth edition (revised in 2012) is recognized by the American National Standards Institute (ANSI®) as an American National Standard (ANSI®/PMI® 99-001-2008) and by the Institute of Electrical and Electronics Engineers - IEEE® 1490-2011 (Seymour & Hussein, 2014). The PMBOK guide is process-based, where it describes work as being accomplished by processes which are consistent with ISO9000. These processes contains inputs (documents, plans, designs, etc), tools and techniques (mechanisms applied to inputs), and outputs (documents, products, etc). The PMBOK highlights the importance of thirteen knowledge assets in regards to project management namely: Project Integration Project Scope, Project Time, Project Cost Management, Project Quality Management, Project Human Resources, Project Communication, Project Risk Management, Project Procurement, Project Safety Management, Project Environment, Project Financial Management and Project Claim Management. We offer the debate that PMBOK's 13 knowledge assets are closely associated with Nonaka's (2000) experiential, conceptual, routine and systemic knowledge framework. Experiential knowledge means skills and know-how that are acquired and accumulated by the individual members through experiences in a particular context at work. Conceptual knowledge is an explicit knowledge. Routine knowledge is tacit knowledge routinized in action and embedded in actions and practices of the organisation whereas systemic knowledge is systematised and packaged explicit knowledge. Based on such an association, PMBOK's knowledge assets are now coined as knowledge assets.

Second, the interactive role of project management and knowledge management is examined from the lifecycle perspective. All construction projects undergo five stages, namely concept, planning (and development), detailed design, construction and closure (PMBOK, 2007; Abanda *et al*., 2015). The existing literature have looked into a project's success from a single point of view i.e. one stage exclusively (Artto *et al*., 2008). Examining the role of knowledge assets in each stage of construction will enable a deeper understanding of how each knowledge asset has contributed uniquely to each construction stage's completion. The completion of one stage will lead to the other as they have a relative relationship, i.e. linear (Archibald *et al*., 2012). It is conceptualised that, not all knowledge assets will play a pertinent role across the different stages of construction management. Some will have important role across all or only for some stages. Construction companies need to understand this phenomenon as it will help them in eliminating or minimising the problems highlighted earlier.

Following is a look at the different stages in project management, and an outline of the hypothesis development. Then results of the statistical techniques applied are presented and discussed. This study is then concluded with a discussion followed by practical implications.

2. MATERIALS AND METHOD

Projects have been defined differently by various authors over the years (e.g. Ohara, 2005; Kerzner, 2009). In this study, a project is defined as a temporary group of activities designed to produce a unique product, service or result (PMI, 2013). Next session elaborates the different stages in project management.

One of the central discussions of the PMBOK guide (PMI, 2013) is the five stages involved in a project management, namely; **Concept** is performed to define a new project by identifying the stakeholders of the project and those who will be impacted by project outputs will be done. In addition, people-related requirements, organisational needs, technical project-related requirements and the needs of the executive and/or business sponsors are also established. **Planning** is a stage where the scope and objectives of the project are defined with the appropriate course of action. Similarly, stakeholders on the operations side of the business will be engaged. **Detailed Design** is a stage where the management of the processes to complete the works defined in the project management plan. Issues such as managing stakeholder expectations and integration of the various project activities and people-related activities. **Construction** is the execution of the construction project, where the progress and performance of the work is tracked, reviewed and regulated. Continuous monitoring provides insight to the health of the project and the assets requiring additional attention. This includes the need to meet the ever-evolving needs and expectations of stakeholders. **Close-out** is utilised to conclude activities and formally complete the project or project phase. As stated earlier, the end of a project is reached when the project's objectives are met. Since project objectives include the creation of project value, and that project value is often dependent upon organisational adoption and utilisation, the project should not be considered closed until organisational adoption and other project success metrics have also been achieved. These stages are linked by the results that they produce at each process. For example, the output achieved in the initiation provides the input for the planning and so on.

2.1. The Outcomes in each Stage

The outcomes of each stage are conceptualised as follows:

Table 1
Outcome of Each Stage

Stage	*Outcome*	*Author(s)*
Concept	Project Authorised (PA) (initial scope defined, budget and resources committed)	Faniran *et al.* (2000); Anderson *et al.* (2006)
Planning	Construction Management Plan (CMP) completed (execution plan and project documents developed)	Anderson *et al.* (2006); Fewings (2013)
Detailed Design	Detailed design completed and ready to construct (RTC)	Anderson *et al.* (2006); Fewings (2013)
Construction	Construction completion within time, budget and scope (CC)	Faniran *et al.* (2000)
Closeout	Business Outcome (BO): Liability period completed, administrative and financial closure, demobilise and record lessons learnt	Anderson *et al.* (2006); Fewings (2013)

2.2. Knowledge Assets

The PMBOK highlights the importance of nine knowledge assets that act as the crucial factors needed in each respective stages: Project Integration Management (7 items), Project Scope Management (5 items), Project Time Management (9 items), Project Cost Management (4 items), Project Quality Management (3 items), Project Human Resources Management (5 items), Project Communication Management (5 items), Project Risk Management (6 items), and Project Procurement Management (6 items).

Each of the nine knowledge assets is broken down into independent processes with each one having its definitive inputs and outputs, as well as a description of the tools and techniques for each process. In 2000, PMI created the PMBOK extension for construction industry specific and has revised its third edition as of 2007. The extension has 4 additional elements that are unique to construction and consist of: (i) Project Safety Management (3 items), (ii) Project Environment Management (3 items), (iii) Project Financial Management (3 items), and (iv) Project Claim Management (4 items).

In essence, there are a total of 13 knowledge assets relevant for construction projects, with a total of 61 asset elements within them. This paper anticipates dynamic interactions of these assets across the different stages, which will be captured via the Partial Least Square estimations.

3. LITERATURE AND HYPOTHESES DEVELOPMENT

The concept stage is the first stage in any construction project and is considered the "quite stage" where the idea of a project is put forth, analysed, debated and considered for development (Saad, 2011 and Archibald *et al.*, 2012). This will culminate into a project charter that will be handed over to an existing or newly engaged project manager. The project charter will be the guiding principles used throughout the project. A conceptual design will be documented for acceptance, and to allow for assessment of the resources requirements that the organisation should commit (Newton, 2015; Zidane *et al.*, 2015 and Langston, 2013).

Those having influence over the outcome of the project, i.e., stakeholders, their expectation and influences should be established to chart the way forward.

Several project management knowledge assets, processes, tools and techniques need to be applied to arrive at the successful completion of the concept stage. Thus, an inference is made that the project management knowledge assets would lead to the following hypothesis:

H1: *The 13 project management knowledge assets have significant influence for the Concept stage's success.*

Successful completion of the Concept stage ensures that the project is authorised (Loosemore, 2003 and Archibald *et al*., 2012), thus becoming the input for the planning stage. The following hypothesis is built on that basis:

H2: *The successful completion of the Concept stage leads to the Planning stage.*

Planning is one of the most important stage in the construction industry. The outcome of the planning stage will be a construction management plan (CMP) document (Zwikael, 2009 and Aouad *et al*., 2010). The CMP contains the detailed objectives of the project, the scope of the project which incorporates inclusions and exclusions of the project, as well as the assumptions and constraints that will be considered (Stefansdottir, 2015; Eynon, 2016). Various knowledge asset components will be utilised in the accomplishment of the CMP such as time management, cost management, project quality management, human resource management, communication management, risk management, procurement management, safety management, environmental management, financial management and claim management plans (PMBOK, 2007). In essence, these details relates to knowledge assets, thus the following hypothesis is established:

H3: *The 13 project management knowledge assets have significant influence for the Planning stage's success.*

The outcome of the planning stage will become the input for the detailed design stage. The following hypothesis is built on that basis:

H4: *The successful completion of the Planning stage leads to the Detailed Design stage.*

In the detailed design stage, the architectural and engineering components required for the construction are produced. In some complex projects, it is necessary to prepare in addition a written final design report (Taranath, 2016 and Smith *et al*., 2016). All revisions to construction materials, machinery, and equipment specifications are also made. The updated schedule, cost estimates and specifications are contained in the final design report. This stage will also include the specifications which outline submittal requirements, allowable products and materials, installation constraints, allowable tolerances, inspection and testing requirements and warrantee requirements. Detailed design is the most expensive stage of a project lifecycle (Buede & Miller, 2016; Eynon, 2016). Thus, it is of great importance that complete and detailed attention is given throughout detailed design. If there were substantial errors during the previous stage, it will be carried out to this stage.

The application of the project management knowledge assets should significantly aid in the detailed design stage, thus the following hypothesis is developed:

H5: *The 13 project management knowledge assets have significant influence for the Detailed Design stage's success.*

The outcome of the successful completion of the detailed design stage will prepare the firm for construction (Kibert, 2016; Smith *et al.*, 2016 and Taranath, 2016). The outcome of the detailed design stage will become the input for the construction stage. The following hypothesis is built on that basis:

H6: *The successful completion of the Detailed Design stage leads to the Construction stage.*

The construction stage starts with the acquisition of the site and mobilisation. Concurrently, the employment of required craftsman, labour and specialists is also executed (Kerzner, 2009; Archibald *et al.*, 2012; Gasik, 2015; Greenhalgh, 2016; Eynon, 2016; and Serrano *et al.*, 2016). The relevant authorisation would have been acquired. The preparation of ground for the actual construction starts.

Once the physical work to construct has been initiated, the CMP and the detailed design will be put in use to produce the product intended with the constraints of schedule, budget and quality. Various project management knowledge areas play essential roles in monitoring and controlling the successful outcome of the construction activity.

The plans and drawing will, from time to time, be revised and enhanced, to ensure that the construction activities proceed without delays (Ranns & Ranns, 2016). Procurement of essential material and machineries will progress and delivered to the site. The vendors will be paid, and claims from subcontractors will be entertained, following inspection and quantities verified (Cunningham, 2016; Ward, 2016). Important resources will be maintained and the construction safety is adhered too (Wanberg *et al.*, 2013 and Love *et al.*, 2016).

All the above activities will require extensive understanding of project management knowledge and the role each process plays, to provide essential feedback for monitoring, control and execution of the construction. The following hypothesis is designed:

H7: *The 13 project management knowledge assets have significant influence for the Construction stage's success.*

The outcome of the successful completion of the construction stage will be the construction completion. The outcome of the construction stage will become the input for the closeout stage. The following hypothesis is built on that basis:

H8: *The successful completion of the construction stage leads to the closeout stage.*

Upon completion of the construction, the product will obtain the certificate of fitness (Buang, 2001) involving liaison with local Government authorities and regulatory bodies. This is followed by handing over the product to the owner or putting the product into service and the liability period start. This is the period where defects are rectified. The organisational resources will be released, the project team will be disbanded. Only a skeleton crew will be maintained. Supplier contracts and agreements will be closed.

Once the liability period is over, the will be administrative and financial closure (PMBOK, 2007). Lessons learnt will be recorded for use in future projects (Paranagamage *et al.*, 2012). Project management knowledge is key to a successful project closure, therefore it is inferred that the project management knowledge assets would lead to the following hypothesis:

H9: *The 13 project management knowledge assets have significant influence for the Closeout stage's success.*

The outcome of the closeout stage will lead to business outcome. The following hypothesis is built on that basis:

H10*: The successful completion of the closeout stage leads to the business outcome.*

4. DATA AND EMPIRICAL FINDINGS

The data for this research was collected using a survey instrument which was sent to 10,000 construction firms in Malaysia. These firms were selected from a population of 67,000 construction firms as provided by CIDB. The Partial Least Square (PLS) Structural Equation Modelling (SEM) technique were applied to confirm the established hypotheses.

A total of 370 firms responded to the survey request, denoting a response rate of 0.5%. The quality of the data received was evaluated from the informants' competency level. All the respondents were Project Managers in the construction firms with a bachelor's degree and possessing more than 10 years in working experience. In addition, all the respondents are certified construction project managers, practising construction management in Malaysia. It is reasonable to assume that the respondents are knowledgeable and competent in answering the questions. Hence, the quality of data received is acceptably high.

Respondents' Profile Analysis

- All participants were male.
- The firms that the participants are currently working with have been in operation for more than 10 years, of which 67% have 5-30 employees and 33% have 31-75 employees.
- Annual revenue of the participants' companies was 67% between RM11-20 million and 33% between RM21-50 million.
- All participants have some form of project management professional certification.

Common Method Bias

Harman's single-factor score was used to test for the presence of common method bias (Podsakoff, *et al.*, 2012; Siponen, *et al.*, 2014; Sheng & Chien, 2016). By constraining (unrotated) factor extraction to one factor, the common method bias is said to be present if the variance accounted for by a single factor is higher than 50% (Roni, 2014). In this study, the single factor solution accounted for only 26.4% of the total variance, suggesting that the common method bias was not a major concern.

Assessment of Reliability

One of the most popular reliability statistics in use today is Cronbach's alpha (Cronbach, 1951). Cronbach's alpha determines the internal consistency or average correlation of items in a survey instrument to gauge its reliability. The data is considered to be acceptable if the Cronbach alpha value is more than 0.7 (Hair *et al.*, 2016). The Cronbach's alpha values between 0.9023 and 0.9784 were obtained (Table 2). As a result, it can be deduced that all constructs within this research are reliable.

Table 2
Summary of Reliability Test

Constructs	*Cronbach's Alpha*
Concept Stage	0.744
Planning Stage	0.975
Detailed Design Stage	0.927
Construction Stage	0.978
Closeout Stage	0.928
Project Authorised	0.937
Construction Management Plan	0.955
Ready to Construct	0.969
Construction Completed	0.932
Business Outcome	0.952

4.1. PLS Outer Model Evaluation

The measurement model is a reflective constructs, and specifies the relationships between the latent variables and their observed indicators. The constructs were subjected to validity and reliability tests (outer model evaluation) using the individual item reliability, composite reliability (CR), Average Variance Extracted (AVE) and AVE^2 tests (Table 3).

Table 3
Summary of the outer model evaluation

Construct	*Composite Reliability*	*AVE*	*AVE^2*
Concept stage	0.886	0.795	0.891
Project Authorised	0.946	0.641	0.801
Planning stage	0.977	0.603	0.776
Construction Management Plan	0.960	0.618	0.786
Detailed Design	0.941	0.696	0.834
Ready to Construct	0.972	0.699	0.836
Construction Stage	0.980	0.643	0.802
Construction Completed	0.972	0.699	0.836
Closeout Stage	0.952	0.689	0.830
Business Outcome	0.960	0.775	0.880

The composite reliability values were more than 0.80, with the AVE values above 0.50. Hence, it indicates a good relationship between the constructs and their indicators. The AVE^2 values were also of good value, which justifies that the constructs are valid and reliable. The outer model evaluation assist to determine the outcome of the following hypotheses: H1, H3, H5, H7 and H9 (refer to Table 4).

Table 4
Selected Hypotheses Decision Table

Stage	*Result*
Concept stage (H1)	2 assets
Planning stage (H3)	28 assets
Detailed Design stage (H5)	7 assets
Construction stage (H7)	27 assets
Closeout stage (H9)	9 assets

Concept Stage

The PLS estimation showed the significance of only two (2) knowledge assets in the Concept stage of the construction companies. The significance was determined based on the factor loadings which were above 0.70, thus indicating the non-importance of fifty nine (59) knowledge assets in this stage. The two significant knowledge assets are (i) Develop Project Charter and (ii) Develop Preliminary Project Scope Statement.

Both of these knowledge assets are part of the "Project Integration" component. *Develop Project Charter* process involves the development of documents that provide an overview of the project, the project's approach and formal authorisation of a project. In addition, the appointment of a project manager will also be authorised via this document. Whereas the *Develop Preliminary Project Scope Statement* addresses and documents the characteristics and boundaries of the construction project. This includes the high level of scope narratives and milestones, the assumptions, constraints, boundaries and risks involved in the project.

These two assets are the foundation that underpins a project in the Concept stage, and in the sample construction companies', they seem to be pivotal. The role and significance of these assets supports the argument provided by Saad (2011); Archibald *et al.*, (2012) and Serrano *et al.*, (2016) in which the assets were found to be paramount, in the context of initiating a construction project. It is interesting to find that the significance of other assets seem to diminish for the Concept stage of the firms. Other knowledge assets could have possibly diminished due to the fact that their relevance is significant in other stages of construction activities.

Planning Stage

The PLS estimation revealed twenty-eight (28) knowledge assets as significant for the Planning stage of the sample companies. This was determined based on the factor loadings which were above 0.70. These twenty-eight knowledge assets would ensure that a comprehensive Construction Management Plan (CMP) is developed. With the CMP, the construction company knows what reports to produce and who should receive the reports. The project manager knows how to monitor project progress and respond to request for changes. The quality standards for the project would have been clearly defined. All the construction activities would have been broken down to manageable portions, a schedule to manage these activities with time, resources required, cost and manpower requirements would have been defined. As in all projects, risks are ever present. Therefore the risk identification, risk analytical methodology and the risk responses would have been documented for immediate utilisation. Similar to risk, the safety and environmental aspects of the project would have been addressed in the Hazard Identification, Risk Analysis and Risk Control (HIRARC) documentation.

Detailed Design Stage

The PLS estimation revealed eight (8) knowledge assets as significant for the Detailed Design stage of the sample companies based on the factor loadings which were above 0.70. Successful completion of these eight knowledge assets would ensure all preliminary works are completed and the project is ready for construction (RTC) and the actual physical structures can be erected (Kibert, 2016; Smith *et al*., 2016 and Taranath, 2016). The following knowledge, essential to start construction works, will be available upon completion of the Detailed Design stage: Site grounds preparation prior to construction, Drainage system specifications and routes, Floor and roof construction specification and details, Electrical services construction specification and details, Water supply facilities and sanitation construction specification, Specification of materials that should be used for the construction, Drawings for specific works ready for use, Critical path method is ready for implementation, Bills of quantities are ready, Details of managing project progress , Handling variation in project , and Specification of substitute construction material available.

The specifications and information above will cover every item the contractor will encounter and the applicable standards to follow. In Malaysia, the contractors tend to favour specifications provided by the Malaysian Architect Association (PAM). Subcontracting or procurement of subcontractors procedures are detailed in this stage (Cunningham, 2016; Ward, 2016).

Construction Stage

The PLS estimation showed 28 knowledge assets were relevant at the Construction stage in the sample companies. The application of these knowledge assets requires extensive understanding of project management tools and skills comprising of monitoring, controlling and executing. A successful application of these 28 knowledge assets during the construction stage should ideally produce the following outcomes: Meets authorities requirement, Completed within schedule, Reduced material wastage, Minimal variation orders, Environment were not affected, Completed within budget, Completed within scope, Optimally resource usage, Minimal safety issues, and Completed within quality requirements.

It is also noted that construction companies do not see the following knowledge assets as relevant to them: Perform Financial Administration & Records, Claim Identification, and Claim Quantification.

"Perform Financial Administration & Records" involves cost filing systems and accounting systems which allows traceability and record lessons learned. This is a crucial knowledge that contributes to project success. In construction companies, they often have their own finance department to handle this function. "*Claim Identification"* and "*Claim Quantification"* becomes significant when extra work has been carried out or requested to be carried out as these works may have been omitted or were not anticipated in the original scope of works.

Closeout Stage

The PLS estimation showed that of the 61 knowledge assets, only nine (9) knowledge assets had factor loadings above 0.70 in the Closeout stage. The successful completion of these nine knowledge assets would ensure the proper closure of the construction project and the following results can be observed:

- ✓ There will be minimal defects
- ✓ There will be minimal rework
- ✓ There will be minimal disputes with sub-contractors, vendors and suppliers
- ✓ The customer will be contended with the final product
- ✓ Realise the benefits of project management
- ✓ Recorded lessons learnt to benefit future projects
- ✓ Identified experienced workers for future projects

After the handover of the product to the owner, there will be liability period. When that is over, the "*Contract Closure"* knowledge is applied to verify that all work and deliverables are acceptable. Thus, the contract is completed.

PLS Inner Model Evaluation

The requirements for the convergence and discriminant had been fulfilled in the outer model evaluation. The tests gave estimated values within the acceptance level, allowing an evaluation and testing of the structural inner model to proceed. The following interpretations are made in relation to H2, H4, H6, H8 and H10 outcomes:

H2: *The successful completion of the Concept stage leads to the Planning stage.*

Bootstrapping procedure (N = 60, 200 resampling) was used to estimate the path relationship estimation for hypothesis H2. The structural path from concept stage (V) to project authorised (PA) [V→PA] was statistically significant ($\beta = 0.78$; $t = 17.14$; $p < 0.001$). The R^2 value of 0.62 or 62.0 per cent suggested that the predictive power of the path relationship as being strong. As shown in Table 4.6, the blindfolding test gave Stone-Geisser's Q^2 values of communality (0.64) and redundancy (0.39), which are above zero, further supporting that the structural path had good predictive relevance (Chin, 1998). The Global Goodness of fit (GoF) for this path hypothesis was 0.63, implying a large goodness of fit (Tenenhaus *et al*., 2005).

Similarly, the structural path from project authorised (PA) to planning stage (W) [PA→W] was statistically significant ($\beta = 0.95$; $t = 86.76$; $p < 0.001$). The R^2 value was 90 per cent, with the Q^2 values of communality (0.60) and redundancy (0.54), and the GoF (0.73). These values strongly support the relevance of the structural path project authorised (PA) to planning stage (W). Thus, the results strongly support hypothesis H2.

H4: *The successful completion of the Planning stage leads to the Detailed Design stage.*

Bootstrapping procedure was used to estimate the path relationship estimation for hypothesis H4. The structural path from planning stage (W) to construction management plan (CMP) [W→CMP] was statistically significant ($\beta = 0.92$; $t = 27.23$; $p < 0.001$). The R^2 value of 85.0 percent shows a strong prediction of the path relationship. The blindfolding test gave Q^2 values of communality (0.62) and redundancy (0.52), which are above zero, further supporting that the structural path had good predictive relevance. The Global Goodness of fit for this path hypothesis was 0.72, implying a large goodness of fit.

The structural path from construction management plan (CMP) to detailed design stage (X) [CMP α X] was statistically significant (β = 0.86; t = 20.96; $p < 0.001$). The R^2 value was 74 per cent, with the Q^2 values of communality (0.70) and redundancy (0.51), and the GoF (0.72). These values strongly support the relevance of the structural path project construction management plan (CMP) to detailed design stage (X). Thus, the results strongly support hypothesis H4.

H6: *The successful completion of the Detailed Design stage leads to the Construction stage*

The structural path from detailed design stage (X) to ready to construct (RTC) [XàRTC] was statistically significant (β = 0.79; t = 12.67; $p < 0.001$). The R^2 value of 63.0 per cent is a strong predictive of the path relationship. The blindfolding test gave Q^2 values of communality (0706) and redundancy (0.44), which are above zero, supporting a good predictive relevance for the path. The Global Goodness of fit for this path hypothesis was 0.66, implying a large goodness of fit. The structural path from ready to construct (RTC) to construction stage (Y) [RTC → Y] was statistically significant (β = 0.78; t = 11.29; $p < 0.001$). The R2 value was 61 per cent, with the Q2 values of communality (0.64) and redundancy (0.38), and the GoF (0.62). These values strongly support the relevance of the structural path ready to construct (RTC) to construction stage (Y). Thus, the results strongly support hypothesis H6.

H8: *The successful completion of the construction stage leads to the closeout stage.*

The structural path from construction stage (Y) to construction completed (CC) [YàCC] was statistically significant (β = 0.82; t = 17.40; $p < 0.001$). The R^2 value of 66.0 percent is a strong predictive of the path relationship. The blindfolding test gave Q^2 values of communality (0.62) and redundancy (0.40), which are above zero, supporting a good predictive relevance for the path. The Global Goodness of fit for this path hypothesis was 0.64, implying a large goodness of fit. The structural path from construction completed (CC) to closeout stage (Z) [CC à Z] was statistically significant (β = 0.86; t = 31.60; $p < 0.001$). The R^2 value was 74 per cent, with the Q^2 values of communality (0.70) and redundancy (0.51), and the GoF (0.72). These values strongly support the relevance of the structural path construction completed (CC) to closeout stage (Z). Thus, the results strongly support hypothesis H8.

H10: *The successful completion of the closeout stage leads to the business outcome.*

The structural path from closeout stage (Z) to business outcome (BO) [Z → BO] was statistically significant (β = 0.69; t = 8.81; $p < 0.001$). The R^2 value was 47 per cent, with the Q2 values of communality (0.77) and redundancy (0.36), and the GoF (0.60). These values strongly support the relevance of the structural path closeout stage (Z) to business outcome (BO). Thus, the results strongly support hypothesis H10.

5. DISCUSSION

Project management knowledge assets are a significant contributor to a project's success (Alavi and Leidner, 2001). Project management knowledge must be made readily available and easily accessible to any construction organisation, consequently making it an organisational asset. In addition, organisational project management capability could also be leveraged to influence future project outcomes.

The following main contexts have been established in this research. First, utilising the concept on knowledge life cycle, the project management knowledge assets should first be identified by construction firms. Subsequently, construction companies should share this knowledge or expertise in a form fit for use, and delivers it to the point of application. The knowledge gained is transformed or greatly enriched when this is applied in performing a task.

In order to further enhance the benefits of the project management knowledge assets, the experiences and values generated by applying this project management knowledge in the construction industry should be shared, used and reused. Dissemination of such assets will thereby increase or even multiply the values generated. These values should be looked into as organisational core values and organisational strategies. As project managers are the key personnel in any construction organisations, they should play a major role in the project environments, through sharing and codifying tacit knowledge associated with the management of former projects.

Second, the outcome of this research showed that of the 61 knowledge assets used, only 60 knowledge assets were found to be relevant. The one knowledge asset that was not perceived as relevant by the sample construction companies was "*Manage Stakeholder*". In any construction projects, there are many stakeholders who may influence the project both positively and negatively. The needs of the stakeholder are not similar for all and can vary at different degrees of importance. In all cases, information needs of the stakeholders should be handled carefully, and the information needs should be managed. Langeroudi *et al.* (2014) stated that previous researches have acknowledged the significance of stakeholder's management in construction project management industry.

Project management teams in Malaysia construction projects, must know the main fundamentals in managing stakeholders, especially those who are key stakeholders. The project success principle contains key stakeholder approval, and their integration with the project (PMI 2013). Effective stakeholder engagement to accommodate stakeholder's analysis in the planning, decision making and implementation of the project is vital, in order to establish some clear project priorities (Erkul *et al.* 2016). Construction companies in Malaysia must adopt effective stakeholder management as well as information distribution management to the stakeholders. This is to avoid potential pitfalls in their projects. The contribution of stakeholders in influencing the outcome of any project cannot be underestimated.

The second objective of this research is to demonstrate that every stage of a construction project has specific outcomes from the perspective of project management, and that the outcome of each stage becomes the input of the subsequent stage.

The five stages in the construction project lifecycle occur in sequence as per the process theory. The process theory is about the dynamics of change over time (Markus & Robey, 1988; Mohr, 1982; Turner *et al*., 2000).

The PLS analysis showed the predictive power, $R^2 > 0.51$, predictive relevance, $Q^2 > 0$, goodness of fit, GoF > 0.36 and the stability of the path estimation, $t > 2$. These results indicate a strong relationship between the Concept stage to the Project Authorised (PA) and PA has a strong relationship with the Planning stage. The paths are significant.

At the planning stage, there were 28 knowledge assets that were relevant, CMP revealed 15 significant outcomes and the Detailed Design stage had 8 relevant knowledge assets with factor loadings above 0.70. Further path estimation was carried out. The predictive power, R^2 was above 0.51, predictive relevance, Q^2

was greater than 0, goodness of fit, GoF was above 0.36 and the stability of the path estimation, t-statistics was above 2. This indicates a strong relationship between the Planning stage to the Construction Management Plan (CMP) and CMP to Detailed Design stage.

The Detailed Design stage had 8 knowledge assets and the Ready to Construct (RTC) had 15 outcomes. The Construction stage had 28 knowledge assets. Further analysis revealed R^2, Q^2, GoF and t-statistics were significant for a strong relationship between Detailed Design stage to RTC and RTC to Construction stage.

Meanwhile, the Construction stage had 28 knowledge assets and the Construction Completed (CC) had 10 outcomes. The Closeout stage had 9 knowledge assets. Thus further analysis for path significance can be carried out. Further analysis revealed a moderately strong relationship between Construction stage to CC and CC to Closeout stage.

Once the construction is completed, the business end of the construction activities comes into play. The overall success of the construction project is determined hereon. The certificate of fitness would have been acquired from Government authorities and the product is fit for use. Then the product will be handed over to the customer or owner. The product will still be under liability period and the responsibility of the contractor is still applicable. This is the period where defects are rectified. Once the obligations are successfully carried out, the administrative and financial closure (PMBOK, 2007) will be carried out and the temporary organisation will be disbanded. The management of the construction companies will record lessons learnt (Paranagamage *et al*., 2012) for future projects. The analysis carried out showed a significant relationship between the Closeout stage and Business Outcome (BO).

6. CONCLUSION

The aim of this study was two-fold. Firstly, to determine which variables were relevant at a particular stage of a construction project's lifecycle. This was determined by the establishment and empirical testing of few hypotheses, namely: H1, H3, H5, H7 and H9. Secondly, we also aimed to examine the presence of continuity between stages, i.e. the output of one stage leads to the input and execution of the next stage. The following hypotheses were established for this purpose: H2, H4, H6, H8 and H10. The structural path of the research model was shown to be positive and significant statistically (+*, sig*).

The project management knowledge assets relevant to the particular stages have been determined. It was noted that of the initial sixty-one project management knowledge assets, managing stakeholders was not present in the findings. This shows that construction companies in Malaysia do not value the relevancy of managing stakeholders. This is potentially one of the critical areas that has significantly contributed to construction project delays, cost overrun and other detrimental matters, which will be discussed further in the next chapter.

Of the sixty-one (61) project management knowledge assets, several assets were also found to be significant in more than one stage, especially in the detailed design stage. Similarly, claim identification and claim quantification were repeated in the closeout stage. This is relevant because a significant amount of claims still occur and will need to be handled and resolved once construction is completed.

The second objective of this research was to demonstrate that every stage of construction projects has specific outcome from the perspective of project management, and that the outcome of each stage becomes the input of the subsequent stage. This objective is supported by the process theory. The theory focuses on the processes and dynamics of change over time, the elements of process theory of which include steps or actions, the intervals between them, and the sequence in which they may, or must, occur (Markus & Robey, 1988) and Mohr (1982). This argument is further supported for project management and construction stages where activities occur in sequence. The content of each activity may affect outcomes, and alternative formulations of activity-sequence combinations can be examined for effectiveness across multiple dimensions (Turner *et al.* 2000).

The findings from the data analysis have indicated that for the sample construction companies, all the five stages were relevant. The research also identified the project management knowledge assets that contribute to project success. Taking from Pareto's principles, 80 percent of the solution is in 20 percent of the issues. Project management knowledge could be the 20 percent which is missing in the Malaysian construction companies. Therefore, when construction companies start using these knowledge assets in the construction activities, it can be assured that the problems currently of *cost overrun*, *project delays, abandonment* and *scope creep* would significantly be reduced. Repeated use of project management will bring about dynamic capabilities.

Construction companies must value project management and be committed to realise benefits of construction project management. Generally, most construction companies are aware of project management knowledge. However, they fear that they have to spend substantial amount of time and effort upfront before any benefit can be realised. This hurdle has been removed for this research and is readily available for construction companies to adopt and utilise it. Top management involvement is paramount.

The research also identified that "*Manage Stakeholder*" is the knowledge asset that was not perceived as relevant throughout the construction activities. Managing stakeholders would allow for monitoring and anticipating for response which could impact the project. Proper management of stakeholders would ensure early detection of issues and mitigation measures could be taken before the issue becomes irreversible and detrimentally affects the project. Managing stakeholders forms part of Project Communication Management (PMI, 2007). Managing stakeholders ideally begins with the "*communications planning*" knowledge asset in the planning stage as advocated by PMBOK. At this stage, the stakeholders are identified, the communications requirements are planned for information distribution to manage the stakeholder's expectations. During the construction stage, the planned communication will become relevant and actively carried out during the construction stage and referred to as "*Managing Stakeholder*".

7. PRACTICAL IMPLICATIONS

The findings have also highlighted the implications of completing each stage of construction. Construction companies could use these outcomes to monitor their own project management implementation effectiveness. Any deviation could highlight areas that need improvements. The research has highlighted that construction projects have distinct stages, and that the outcomes of successfully completing that stage becomes the input for the subsequent stage. Success is amplified when one stage is fully completed before proceeding to the nest stage. Any issues not fully addressed in one stage will spill over to the subsequent stages and have severe consequences. Hence, as far as reasonably practicable, all construction companies should strive to complete the five stages of construction, namely: Concept stage, Planning stage, Detailed Design stage, Construction stage and the Closeout stage.

REFERENCES

Abanda, F.H., Vidalakis, C., Oti, A.H. and Tah, J.H.M. (2015). A critical analysis of Building Information Modelling systems used in construction projects. *Advances in Engineering Software*, 90, pp. 183-201.

Abdul-Rahman, H., Takim, R. and Min, W. S. (2009) Financial-related causes contributing to project delays, *Journal of Retail & Leisure Property*. 8 (3). pp. 225-238.

Abdul-Rahman, H., Alashwal, A.M. and Abdullah, A.A. (2016). Abandoned Housing Projects in Malaysia: Risk Management Capabilities during Rehabilitation. ArchNet-IJAR, 10(2).

Adnan, H., Jusoff, K. and Salim, M. K. (2008) The Malaysia construction industry's risk management in design and build. *Journal of Modern Applied Science*. 2(5). pp. 27-33.

Alavi, M. and Leider, D. (2001) Knowledge Management and knowledge management systems: Conceptual foundations and research issues. *MIS Quarterly*. 25(1). pp. 107-136.

Alinaitwe, H., Apolot, R. and Tindiwensi, D. (2013) Investigation into the Causes of Delays and Cost Overruns in Uganda's Public Sector Construction Projects. *Journal of Construction in Developing Countries*. 18(2). pp. 33-47.

Anderson, J., Huhn, M., Rivera, D. M. and Susong, M. (2006) *Phases of the Construction Project, in the Construction Project: Phases, People, Terms, Paperwork, Processes*. American Bar association, USA.

Aouad, G., Ozorhon, B. and Abbott, C. (2010), "Facilitating innovation in construction: directions and implications for research and policy", *Construction Innovation: Information*, Process, Management, Vol. 10 No. 4, pp. 374 94.

Archibald, R., Di Filippo, I. and Di Filippo, D. (2012). The six-phase comprehensive project life cycle model including the project incubation/feasibility phase and the post-project evaluation phase. *PM World Journal*. 1(5), pp.1-40.

Archibald, R.D. and Archibald, S. (2016). *Leading and Managing Innovation: What Every Executive Team Must Know about Project, Program, and Portfolio Management*. (Vol. 22). CRC Press.

Artto, K., Kujala, J., Dietrich, P. and Martinsuo, M. (2008). What is project strategy?

Awad, E. and Ghaziri, H. (2004), 'Knowledge Management'. Pearson Education India.

Bong, K. (July 214, 2017). DPM dismayed at hospital delay. Borneo Post Online. *http://www.theborneopost.com/2017/07/14/dpm-dismayed-at-hospital-delay/*

Buang, S. (2001). Certificate of Fitness: Easy to understand, difficult to Implement. [Online] Available from *http://www.hba.org.my/articles/salleh_buang/2001/certificate_of_fitness.htm*. [Accessed: 26th March 2016].

Buede, D. M. and Miller, W. D. (2016). *Title The Engineering Design of Systems: Models and Methods*. Illustrated & revised ed. Wiley Series in Systems Engineering and Management. USA.

Chong, H. Y. and Preece, C. N. (2014). Improving construction procurement systems using organizational strategies. *Acta Polytechnica Hungarica*. 11(1). pp. 5-20.

Cronbach, L. J. (1951). Coefficient alpha and the internal structure of tests. *Psychometrika*. 16, pp. 297-334.

Cunningham, T., (2016). The Function and Format of Bills of Quantities: An Irish Context. Report prepared for Dublin Institute of Technology, Retrieved on 23 August 2016 from *http://arrow.dit.ie/beschreoth/54/*

Dubey, A. & Kamat, S. (2016). Relative Importance of Project Management Knowledge Areas in Succefful Completion of Project. International Conference on Science & Technology for Sustainable Development, pp. 152-156.

Endut, I. R., Shehu, Z., Akintoye, A. and Jaafar, A. (2009). Cost and Time of Construction Projects in Malaysia. In Fifth International Conference on Construction in the 21st Century (CITC-V), Collaboration and Integration in Engineering, Management and Technology, May 20-22, 2009, Istanbul, Turkey.

Erkul, M., Yitmen, I., and Celik, T. (2016). Stakeholder engagement in mega transport infrastructure projects. *Procedia Engineering*, 161, pp.704-710.

Eynon, J. (2016). *Construction Manager's BIM Handbook*. John Wley & Sons. USA

Faniran, O. O., Love, P. E. D. and Smith, J. (2000). Effective Front - End Project Management, A key Element in Achieving Project Success in Developing Countries, 2nd International Conference on construction in Developing Countries:

Challenges facing the construction industry in developing countries, 15 –17 November, Gabarone, Botswana. [Online]. Available from *http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.196.4461&rep=rep1&type=pdf*. [Accessed: 2nd October 2015].

Fewings, P. (2013). *Construction Project Management: An Integrated Approach*. Routledge, USA.

Frey, P., Lindner, F., Muller, A. and Wald, A. (2009). Project Knowledge Management-Organisational Design and Success Factors. 42nd Hawaii International Conference on System Sciences, HICSS '09.

Gasik, S. (2015). An Analysis of Knowledge Management in PMBOK® Guide. *PM World Journal*. IV(1). pp. 1-13.

Greenhalgh, B., 2016. *Introduction to Construction Contract Management*, Routledge Publication, USA.

Hair Jr, J.F., Hult, G.T.M., Ringle, C. and Sarstedt, M. (2016). A primer on partial least squares structural equation modeling (PLS-SEM). *International Journal of Project Management*, 26 (1), pp. 4 - 12.

Jaffar, M. and Radzi, N. M (2013). Level of Satisfaction and Issues with procurement system used in the Malaysian public sector'. *Australasian Journal of Construction Economics and Building*. 13 (1). pp. 50-65.

Jahanshahi, A. A., and Brem, A. (2017, Does Real Options Reasoning Support or Oppose Project Performance? Empirical Evidence from Electronic Commerce Projects, *Project Management Journal*, 48 (4), 39–54.

Jatarona, N. A., Yusof, A. M., Ismail, S., & Saar, C. C. (2015). Problems in public construction project in Malaysia: Evidence from National Audit Report. In *Proceedings of the 26th International Business Information Management Association Conference - Innovation Management and Sustainable Economic Competitive Advantage: From Regional Development to Global Growth, IBIMA 2015* (pp. 811-817). International Business Information Management Association, IBIMA.

Kerzner, H. (2009). *Project management: A Systematic Approach to Planning, Scheduling and controlling*. 10th Ed. John Wiley & Sons Inc.

Kibert, C. K. (2016). *Sustainable Construction: Green Building Design and Delivery*. John Wiley & Sons. USA.

Kwatsima, S. A. (2015). *An Investigation into the Causes of Delay in Large Civil Engineering Projects in Kenya*, Master Thesis, Jomo Kenyatta University of Agriculture and Technology, Kenya, Africa.

Langeroudi, N. M. A, Anisi, Y., Moghaddam, F. F., Pourmahdi, K., Abadi, M. F., Langeroudi, N. M. A. B. and Rastimeymandi. R. (2014). Improvement of Stakeholders Management In Malaysian Construction Projects: A Review. Australian Journal of Basic and Applied Sciences, 8(1): pp. 118-125.

Langston, C., (2013). "Development of generic key performance indicators for PMBOK® using a 3D project integration mode", *Australasian Journal of Construction Economics and Building*, 13 (4), pp. 78-91.

Lewis, J. (2005), 'Project Planning, Scheduling, and Control: a hands-on guide to bringing projects in on time and on budget'. Fourth Edition, McGraw-Hill.

Loosemore, M. (2003). Essentials of Construction Project Management. *Construction Management Series*. UNSW Press.

Love, P., Teo, P., Morrison, J., and Grove, M. (2016). "Quality and Safety in Construction: Creating a No-Harm Environment." *Journal of Construction Engineering and Management*, Volume 142, Issue 8.

Love, P., Teo, P., Morrison, J., and Grove, M. (2016). "Quality and Safety in Construction: Creating a No-Harm Environment." *Journal of Construction Engineering and Management*, Volume 142, Issue 8.

Markstein, B. (2015). The Importance of Construction to State Economies. Associated Builders and Contractors, [online]. Available from: *http://www.abc.org/NewsMedia/ConstructionEconomics/StatebyStateConstructionEconomics/tabid/7497/entryid/3655/the-importance-of-construction-to-state-economies.aspx*. [Assessed: 25 October 2014].

Markus, M. L. and Robey, D. (1988). Information technology and organizational change: Causal structure in theory and research. *Management Science*. 34(5). pp. 583-598.

Memon, A. H., Rahman, I. A., Abdullah, M. R. and Azis, A. A. A. (2012). Time Overrun in Construction Projects from the Perspective of Project Management Consultant (PMC). *Journal of Surveying, Construction and Property*. 2(1). pp. 54-66.

Memon, A. H. and Rahman, I. A. (2014). Budget overrun issue in construction projects of southern part of Malaysia. *International Journal of Civil Engineering and Built Environment*. 1(1). pp. 1-6.

Mohr, L. B. (1982). *Explaining organizational behaviour*. Jossey-Bass, San Francisco.

Newton, P. (2015). Managing Project Scope. Project Skills. Free management e-book. [Online] Available from *http://www.free-management-ebooks.com/dldebk-pdf/fme-project-scope.pdf*. [Accessed: 23th January 2016].

Nonaka, I., Toyama, R. and Konno, N. (2000). SECI, Ba and Leadership: a Unified Model of Dynamic Knowledge Creation. *Long Range Planning*. 33. pp. 5-34.

Ofori, G. (2016). *Construction in Developing Countries*: Current imperatives and potential. Creating built environments of new opportunities, 1, pp. 39.

Ohara, S. (2005). *A guide of project & program management for enterprise innovation*. Project Management Association of Japan (PMAJ). Revision 1.

Paranagamage, P., Carrillo, P. M., Ruikar, K. D. (2012). Lessons learnt practices in the UK construction sector: current practice and proposed improvement. *Engineering Project Organisation Journal*, 2(4), pp. 216-230.

PMI (2007). *Construction Extension to A guide to the project management body of knowledge* (PMBOK® Guide) (2007 edition). Newtown Square, PA: Project Management Institute.

PMI (2013). *A guide to the project management body of knowledge* (PMBOK® Guide) (5th Ed.). Newtown Square, PA: Project Management Institute.

Podsakoff, P. M., MacKenzie, S. B., & Podsakoff, N. P. (2012). Sources of method bias in social science research and recommendations on how to control it. *Annual Review of Psychology*, 63(1), pp. 539-569.

Polyaninova, T. (2011). Knowledge Management in a Project Environment: Organisational CT and Project Influences. *Vine*, vol. 41, issue 3.

Ranns, R. H. B. and Ranns, E. J. M. (2016). *Practical Construction Management*. Revised ed., Routledge, USA.

Roni, S, M. (2014). Introduction to SPSS. SOAR Centre, Graduate Research School, Edith Cowan University, Joondalup, Australia. [Online] Available from *https://www.researchgate.net/publication/262151892*. [Accessed: 22th June 2016].

Saad, A. (2011). Factors Impacting the Project's Life Cycle. Available from *http://www.g-casa.com/conferences/vietnam/paper/Saad.pdf*. [Accessed: 21st October 2015].

Serrano, D., Suárez, G., Molina Bas, O., and Cruzado, I. (2016). Feasibility Study for the Construction of Multi-Story Parking through a Public-Private Partnership the University of Puerto Rico at Mayagüez. Construction Research Congress 2016: pp. 341-350. Ranns, R. H. B. and Ranns, E. J. M. (2016). *Practical Construction Management*. Revised ed., Routledge, USA.

Sheng, M.L. and Chien, I. (2016). Rethinking organizational learning orientation on radical and incremental innovation in high-tech firms. *Journal of Business Research*, 69(6), pp. 2302-2308.

Siang, L. F. and Yih, C. H. (2012). A Comparative Approach of Japanese Project Management in Construction, Manufacturing and IT, The 8th International Conference on Asia Pacific Business Innovation and Technology Management Industries, *Procedia - Social and Behavioral Sciences.* 57. pp. 193-200.

Siponen Siponen, M., Adam Mahmood, M., & Pahnila, S. (2014). Employees' adherence to information security policies: An exploratory field study. Information & Management, 51(2), pp. 217-224.

Smith, J., Jaggar, D.M. and Love, P. (2016). *Building Cost Planning for the Design Team*. Illustrated & revised ed. Routledge, USA.

Stefansdottir, A, O. (2015). Feasibility studies in construction projects in Iceland. [Online]. Available from *http://skemman.is/stream/get/1946/20515/47067/1/Feasibility_studies_in_construction_projects_in_Iceland.pdf* [Accessed: 12th July 2015].

Takim, R. and Adnan, H. (2008). Analysis of effectiveness of construction projects success in Malaysia. *Asian Social Science*. 4(7). pp. 74-91.

Taranath, B.S (2016). *Structural Analysis and Design of Tall Buildings: Steel and Composite Construction*. Illustrated Ed. CRC Press. USA.

Tenenhaus, M., Esposito Vinzi, V., Chatelin, Y. and Lauro, C. (2005). PLS path modelling. *Computational Statistics and Data Analysis*. 48(1). pp. 159-205.

Turner, J. R., Keegan, A. and Crawford, L. (2000). "*Learning by experience in the project-based organisation*", presented at the Proj. Manage. Inst. (PMI) Res. Conf., Newtown Square, PA.

Wanberg, J., Harper, C., Hallowell, M., and Rajendran, S. (2013). "Relationship between Construction Safety and Quality Performance." *Journal of Construction Engineering Management*, 10.1061/(ASCE)CO.1943-7862.0000732, 04013003.

Ward, G. (2016). *The Project Manager's Guide to Purchasing: Contracting for Goods and Services*, Illustrated ed., CRC Press, USA.

Yusuman, N. M., Adnan, H. and Omar, A. F. (2008). Clients 'perspectives of risk management practice in Malaysia construction industry. *Journal of Politics and Law*. 1(3). pp. 121-130.

Zidane, Youcef J.-T.; Johansen, A., Andersen B., Hoseini E. (2015). "Time-Thieves and Bottlenecks in the Norwegian Construction Projects, 8th Nordic CEO, *Procedia Economics and Finance*. Volume 21, 2015, pp. 486–493.

Zin, M. R., Mohamad, M. I., Mansur, S. A. and Bing T. D. C. (2008). Guidelines for the Preparation and Submission of Work Schedule for Construction Project. *Malaysian Journal of Civil Engineering* 20(2). pp. 145-159. Elias, S. and Ismail, N. (2012). The usage of critical path method software in Malaysia construction. T*he International Journal of Knowledge, Culture and Change Management*. 11(5). pp. 77-88.

Zwikael, O. (2009). "Critical planning processes in construction projects", *Construction Innovation*, 9 (4), pp. 372 87.