



**MITIGATION OF PROBLEMS BY PROJECT MANAGERS DURING
INDUSTRIAL REVOLUTION 4.0 IN THE KLANG VALLEY, MALAYSIA**

By

MOHD HARIS BIN MOHD SAAD

**Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, in
Fulfilment of the Requirements for the Degree of Master of Science**

September 2022

FRSB 2022 19

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Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfilment of the requirement for the degree of Master of Science

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September 2022

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Construction projects in Malaysia especially in Klang Valley are often challenged with issues such as delay, safety and quality because the issues kept recurring. These are common problems in this industry which are caused either by human behaviour, nature or working surrounding environment which influences the situation. Lack of communication contributes most on the emerging issues. Strong communication behaviour is important to mitigate the arising issues in construction projects. The solutions had been suggested by the previous studies but the solution haven't solved. The existence of hierarchy in the workflow sometimes reduces the speed of the construction work progress. The objectives are to identify the types of issues that are commonly observed at construction site projects, to investigate the methods to solve the issues observed at construction site projects and to determine the mitigation methods to overcome the issues using relevant technologies of I.R 4.0 that match the type of problems to improve the working climate. The implementation of I.R 4.0 in construction projects seems effective to mitigate issues in construction projects as compared to traditional methods. Most of the interviewees agree that the implementation of I.R 4.0 as seen in the use of either gadgets, software or tools in their working environment contribute to the efficiency of their work and smoothed the work process among government sectors, government link companies, consultants and contractors. The efficiency of the communication between the personnel involved increases the success rate of the projects in terms of completion time. This study applies a mixed-method approach which consists of survey and semi-structured interviews. This is to ensure a rigorous study conduct where triangulation of data is performed. 150 online and printed questionnaires were distributed to selected respondents. Among these, the printed copies of the questionnaire were distributed to government staffs, consultants and contractors. Out of the 150 questionnaires distributed, only 36 were returned and analysed statistically using SPSS. The major focus of the data collection process was the qualitative semi-structured interviews in which eight participants were interviewed; whereas the other seven participants could not be interviewed for personal reasons. The eight interviewees are two government staff, one consultant and five contractors. The depth of information is obtained from the

qualitative data analysis. The interview sessions were conducted online due to the restrictions enforced because of Covid-19 pandemic. Nvivo 1.6 was used for qualitative data analysis after the transcription process was done. The results from the analysis show that interviewees and respondents employing the I.R 4.0 tools in their projects and will lead the road of successful in construction projects towards the future, and ultimately, the use of these I.R 4.0 tools would benefit the construction project site personnel to their working surrounding climate.



Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Master Sains

**MENGURANGKAN PERMASALAHAN OLEH PENGURUS PROJEK
SEMASA REVOLUSI INDUSTRI 4.0 DI LEMBAH KLANG, MALAYSIA**

Oleh

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Projek pembinaan di Malaysia terutamanya di Lembah Klang sering menghadapi cabaran dengan pelbagai isu seperti kelewatan, keselamatan dan kualiti. Permasalahan ini adalah lumrah di dalam industri ini di mana ia disebabkan sama ada oleh tindakan manusia, semulajadi atau suasana persekitaran yang mendorong situasi ini. Kelemahan dalam berkomunikasi menyumbang kepada timbulnya isu-isu. Tindakan komunikasi yang baik sangat penting untuk mengurangkan isu yang meningkat di dalam projek-projek pembinaan. Beberapa penyelesaian telah dicadangkan oleh penyelidik terdahulu tetapi jalan penyelesaian belum lagi diperolehi. Kewujudan hirarki di dalam aliran kerja adakalanya mengurangkan kelancaran di dalam kerja pembinaan. Objektif-objektif ialah mengenalpasti jenis-jenis isu yang biasanya dilihat di tapak projek pembinaan, untuk menyiasat kaedah-kaedah untuk menyelesaikan, untuk menyiasat kaedah untuk menyelesaikan masalah yang dilihat di tapak projek pembinaan dan untuk menentukan kaedah mengurangkan bagi mengatasi masalah menggunakan teknologi I.R 4.0 yang berkaitan yang sesuai dengan jenis permasalahan bagi menambahbaik suasana bekerja. Pelaksanaan Industri Revolusi 4.0 di dalam sektor pembinaan nampaknya berkesan untuk mengurangkan isu-isu di dalam projek-projek pembinaan jika dibandingkan dengan kaedah-kaedah tradisional. Kebanyakan orang yang ditemuduga bersetuju bahawa pelaksanaan I.R 4.0 dapat dilihat sama ada penggunaan gajet-gajet, perisian atau peralatan didalam persekitaran kerja telah menyumbang kepada keselesaan kerja mereka dan melancarkan proses kerja di kalangan sektor-sektor kerajaan, syarikat separa kerajaan, perunding dan kontraktor-kontraktor. Kelancaran komunikasi antara orang yang terlibat telah meningkatkan kadar kejayaan projek-projek dalam erti kata jangka masa siap. Kajian ini menggunakan pendekatan kaedah-campuran terdiri dari soalselidik serta temuduga separa berstruktur. Ini untuk memastikan kajian yang tepat dibuat dimana persilangan data dilakukan. 150 soalan secara talian dan soalan dalam bentuk cetakan diedarkan kepada para responden. Salinan cetakan soalselidik telah diedarkan kepada kakitangan kerajaan, perunding dan para kontraktor. Dari 150 soalselidik diedarkan, cuma 36 yang memberi maklumbalas dan analisa secara statistik menggunakan SPSS telah digunakan. Tumpuan utama proses pengumpulan data adalah dengan kualitatif temuduga separa-berstruktur di mana lapan peserta telah

ditemuduga manakala tujuh peserta lagi tidak dapat mengambil bahagian atas alasan peribadi. Lapan peserta itu adalah dua kakitangan kerajaan, satu perunding dan lima dari syarikat kontraktor. Kedalaman maklumat telah diperolehi pada data analisa kualitatif. Temuduga dilakukan secara dalam talian kerana terikat perintah kawalan pergerakan suasana pandemik Covid-19. Nvivo 1.6 telah digunakan untuk menganalisa data kualitatif selepas proses transkrip dilakukan. Secara amnya, keputusan dari analisa menunjukkan orang yang ditemuduga dan responden mengguna peralatan I.R 4.0 di dalam projek mereka dan di mana membuah hasil dalam projek-projek pembinaan di masa hadapan, dan mutakhir, penggunaan peralatan I.R 4.0 ini akan memberi manfaat kepada pekerja tapak projek pembinaan untuk menambahbaik suasana persekitaran kerja mereka.



ACKNOWLEDGEMENTS

First and foremost, thanks and all praises most go to Allah, for giving me the opportunity and the ability to complete this study.

This Master study may be considered as my first major study project.

My greatest gratitude goes to my supervisor, Dr. Siti Sarah binti Herman and co-supervisor, Ar. Aznida binti Azlan, who patiently provided supervision, advices, and guidance on my ongoing study.

I would like to thank staffs of Universiti Putra Malaysia who have provided guidance and assist me during thesis and study in progress.

This thesis was submitted to the Senate of Universiti Putra Malaysia and has been accepted as fulfilment of the requirement for the degree of Master of Science). The members of the Supervisory Committee were as follows:

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LIST OF ABBREVIATIONS

AQPI	Architectural Quality Performance Inspection
BEM	Board Engineers of Klang Valley
BIM	Building information Modelling
BREEAM (UK)	Building Study Establishment's Environmental Assessment Method
BQSM	Board of Quantity Surveyors Klang Valley
CASBEE	Comprehensive Assessment System for Building Environmental Efficiency (Japan)
CIDB	Construction Project Development Board
CIMP	Construction Project Master Plan CIOB Chartered Institute of Building
CITP	Construction Project Transformation Plan
CONQUAS	Construction Quality Assessment
DOSH	Department of Occupational Safety and Health
GBI	Green Building Index
GDP	Gross Domestic Product
Green Pass	Green Performance Assessment System
GreenRE	Green Real Estate by Real Estate and Housing Developments Association or REHDA
IBS	Industrial Building System
LAM	Board of Klang Valley Architect
LEED	The Leadership in Energy and Environmental Design (US)
LLM	Klang Valley Highway Authority
MAMPU	Modernisation and Management Planning Unit
NIOSH	National Institute of Occupational Safety and Health
PH JKR	PWD Green Rating Assessment Scheme

CHAPTER 1

INTRODUCTION

This chapter consists of background of the study issue and addresses the study goal and related goals, study questions, study benefits, and contribution of the study highlighted on the study background and why I.R 4.0 was chosen and relation for study. Later will focus on problem statement what the scenario and issues are related in the construction projects and later how is justification of study confirm on the issues the be discussed in this study. Study aim and study objectives will be identified and followed by the study on process and methodology. Limitations, constraints, and methods of data collection will also be highlighted in this chapter. Contribution of knowledge will also discuss for benefits of Project Managers and continue with tentative of the chapter.

1.1 Background of Study

Currently, the Twelfth Malaysia Plan (12MP) 2021 to 2025 is already in line with the shared prosperity vision that is outlined on three pillars: economic empowerment, environmental sustainability, and social re-engineering. New sources of growth such as Industrial Revolution (IR) 4.0, the digital economy and integrated regional development will be included in the economic empowerment dimension (MAMPU, 2019). The strategic plan to achieve the nation's aspiration, 'Shared Prosperity Vision 2030' is to provide a balanced lifestyle to all levels of Malaysian socioeconomic groups in 2030. The Department of Economic and Social Affairs Disability of United Nation, by 2030, has identified 17 sustainable development goals (SDGs) that are aimed to transform the world. In relation to that, the third goal in the list (Good Health and Well-Being) aims to substantially reduce the number of deaths and illnesses from hazard. It is within this context that safety issues are included in this study.

In the fourth quarter of 2019, Malaysia's Gross Domestic Product (GDP) grew 3.6% from 4.4% in the previous quarter. Malaysia's construction sector recovered 1.3% in the fourth quarter of 2019. The value of construction work done in the fourth quarter 2019 seems to have recovered by 1.3% (Q3 2019:-0.6%) year-on-year basis, amounting to RM37.0 billion (Q3 2019: RM36.1 billion). The civil engineering sub-sector soared high at 7.9% in the fourth quarter 2019, followed by the special trades activities sub-sector that recorded 3.8%. The value of construction work recorded in 2019 amounted to RM146.4 billion, and this value increased by 0.6% compared to RM145.5 billion in the previous year (Department of Statistics Malaysia, 2020).

The value of GDP in Construction project is small compared to other industries. Nonetheless, the construction sector gives effects on other industries; therefore, it is a

vital business and is regarded as a major contributor to the nation's economy (Herman, 2016). Organisation Strategic Plan 2021-2025 (PSO 2021-2025) developed by Public Work Ministry, (PWM, 2021) is a continuous plan which follows through the earlier strategic plan that was enacted from 2016 until 2020. It is noted that the industry is made up of many players including contractors, developers, clients (government agencies and private entities), management teams, engineers, architects, surveying consultants, manufacturers, material suppliers and plant hirers. The government is an important player in the industry through its agencies: The Ministry of Works, Public Work Department (PWD), Construction project Development Board (CIDB), the Contractor Service Centre (PKK), Board of Engineers of Malaysia (BEM), the Board of Architects Malaysia (LAM) and Board of Quantity Surveyors Malaysia (BQSM). These agencies play a significant role in the growth and development of Malaysia construction projects (Kamal et al., 2012; Tengan et al., 2017). However, the hard work of construction teams to build the environment causes the industry to face some serious issues. As a result, the construction teams lose focus during constructing works due to the limited time or unsupportive surrounding environment which creates other issues (Radujkovic et al., 2017).

According to the Board of Engineers Malaysia (BEM, 2019), there are 2549 registered private engineering consulting companies in Malaysia. These companies are categorised according to their engineering disciplines namely civil, mechanical and electrical engineering. The Board of Architect Malaysia (LAM, 2019) registered 2152 architectural consulting companies and 848 quantity surveyors consulting companies that are currently in the list of the Board of Quantity Surveyor Malaysia (BQSM, 2019). The increments of GDP on Malaysia's construction projects from the previous year will boost the contribution made to other related sectors such as information technology and manufacturing industries as positive economic growth generally emerges from the infra-structures and buildings for operational purposes.

In the Fourth Industrial Revolution, the machines began to manage themselves as well as the production process, so they needed to use less manpower. The development of automation derives from the inventions of computer, communication and internet technologies (Brondoni et al., 2019; Redden et al., 2017). This advanced technology, called the "Internet of Things" (IoT) allows a product factory to manage the factory virtually. The Fourth Industrial Revolution or Industry 4.0 was first mentioned by Bosch at the Hannover Trade Fair in 2011. Experts at the trade fair highlighted that a new Industrial Revolution has arrived with innovations brought into production by the modern face of the information era. Because the German government believed the experts, the Fourth Industrial Revolution eventually becomes official. After the trade fair, a working group on the Fourth Industrial Revolution was established. Bosch executive, Siegfried Dais, and SAP AG executive, Henning Kagermann, co-chaired the working group. For construction projects, the use of smart machinery, internet and high-tech tools along with smart applications is well applied. The real-time monitoring, internet, BIM, computer technology and smartphones are the examples of I.R 4.0 tools used in construction projects (Rivard et al., 2000; Arslan et al., 2014). The strategic plan focuses on digitalisation in construction projects together with new norms and evolution on Industrial Revolution 4.0 (I.R 4.0). PWM, supported by its

agencies such as Public Work Department (PWD), Construction project Development Board (CIDB), Malaysia Highway Authority (LLM), Malaysia Engineering Board (BEM), The Board of Architects (LAM), and Board of Quantity Surveyor (BQSM) will be working together for the next five years. Therefore, this strategic plan includes current and potential future challenges including projects that boost the economy, progress, technology, innovation and digitalisation in construction projects (PWD, 2021; Thompson et al., 2017).

1.2 Problem of Statement

There are various issues involving construction projects, and the most common issues are usually due to the delay in payment, extension of time, quality of work and safety at construction projects (Mossalam, 2018; Benz, 2018). Besides, other issues are also identified which include the cost of construction projects, scope of work, environment of work and lack of resources (Mossalam, 2018). Particularly, construction projects in Klang Valley have to depend on groups of unskilled foreign workers, minimal use of technology and little enforcement of policy merit (Kamal et al., 2012) which may jeopardise the workmanship quality. In fact, the quality management system recommends all nations to incorporate differentiation knowledge in construction works (Zakuan et al., 2014). There are also other circumstances that may affect the completion of the construction works such as war, civil war, revolution and riot. Furthermore, natural disaster such as earthquake or flood and human-made disaster such as nuclear or bomb explosion, aircraft pressure wave, site possession delay or other trades of sequence of work delay can also hinder the construction projects (PWD 203A, 2010; PAM, 2018). Essentially, human-related factors such as competency, commitment, communication and cooperation are important qualities for successful construction projects (Tengan et al., 2017). These factors are the core elements in the relationship-based procurement approach that reinforces the need and viability of such procurement methods in Klang Valley.

During the construction period, issues such as quality, safety and delay are recurring issues that constructors have to deal with. There have been solutions suggested by previous studies in overcoming this, but the issues continue to persist. In this study, the identification of issues is demonstrated at the beginning as observed by several authors in their articles. Identification of issues is vital in obtaining accurate information based on situations that have happened at construction project sites before. From this point, it is possible to divide the case into a few topics related to the current situation happening at construction project sites. From the identification of problem which were detected during construction period and from literature review, the studies need to explore more solution on how and what type of action should be taken before or during construction in progress. The solution can be identified by conduct data collection from the project staff which involved in construction project. Then, the studies is able to investigate possible solutions to overcome the problems observed during the construction period. Following the

identified solutions of the issues, the mitigation method will be determined to solve the problem such as applying the I.R 4.0 tools.

1.3 Justification of Study

Generally, there are many issues identified at construction site projects (Thompson et al., 2017 and Nica et al., 2017); however, for the purpose of this study, only three main issues will be discussed which are quality, delay and safety of construction projects. The implement of issues management in Klang Valley construction project is to overcome the problem during construction period (Omer et al., 2019). Therefore, this study focuses on examining the use of I.R 4.0 tools by project managers at various construction projects in Klang Valley to mitigate issues identified at construction projects. This study aims to give benefit to construction projects and to improve the nature of working environment in terms of quality, time and safety. Poor workmanship represented by the lack of working experience and supervising technique typically contribute to poor product quality. On the other hand, delay is resulted from cost overrun, interrupted project schedule or late payment (debited or credited). Additionally, safety issues are impacted from the lack of awareness in working environment and from avoiding the safety regulations at construction site projects.

Furthermore, the findings of this study will benefit the social and economy of construction management, for project manager is the backbone and the main person to oversee the construction projects, to monitor and supervise work flows to comply with the time-line as well as to ensure that the time-line is met with the scheduled plan. Project managers are also responsible to ensure that the project is carried out within the budget and is following strict security regulations. Therefore, a project manager that equally functions as a leader at the construction site, should have a wide project management experience and should be equipped with suitable level of skills so that the subordinates are able to follow orders accordingly and work responsibly. Creating positive relation will benefit the strong communication results in construction project (Rahman et al., 2018).

The top management is also responsible to ensure that the management team is conscious of the hazardous awareness. They should also be able to control their feelings and emotions, so they can demonstrate a suitable working behaviour to their team members to ensure the positive impact is demonstrated effectively within the team. This strategy helps both the top management and low management on improving the working environment climate (Chen et al., 2017). The project manager is the key to link each stakeholder at the construction sites. One of the key roles of project managers is integrating various contractors and coordinating the team members as well as reminding them that they should not be individualistic during the construction period. It seems that teamwork and awareness of hazard and injuries are commonly emphasised in construction projects (Chen et al., 2017).

Expertise, understanding and experience are the important source in construction project (Yusof et al., 2018). Lack on safety awareness would direct to non-compliance to occupational safety and health to Klang Valley construction team (Jamalullah et al., 2018). Incorporating the findings from previous study would build a framework to find the best solution to mitigate issues at construction sites. This study is to investigate the construction issues in this industry as well as to explore the motivation and proposition factors to mitigate the problems found in construction projects in Klang Valley. The Internet of Things(IoT) will benefits to improve progress and reduce delay in construction project (Ibrahim et al., 2021). The defects management need to be focused more on compliance, coordination and skills as a process on quality awareness (Hashim et al., 2018). The findings could demonstrate interesting relationships and patterns of emotional intelligence among construction project participants. The readiness on adoption I.R 4.0 is the way on improvement the benefits to the construction project (Tayib et al., 2022). Besides, the implementation of 4Cs (Communication, Coordination, Cooperation and Collaboration) would be expanded the complex of incorporation on issues in construction project (Tey et al.,2018). Therefore, this study generally aims to focus on job performance's to benefit Project Managers in the economic and social perspectives to mitigate the issues for a better future.

1.4 Aim

To ascertain a solution and mitigation of achieving improved working climate for project managers in the Klang Valley construction project .

1.5 Objectives

- 1 To identify the types of issues that are commonly observed at construction site projects;
- 2 To investigate the methods to solve the issues observed at construction site projects; and
- 3 To determine the mitigation methods to overcome the issues using relevant technologies of I.R 4.0 that match the type of problems to improve the working climate.

1.6 Methodology

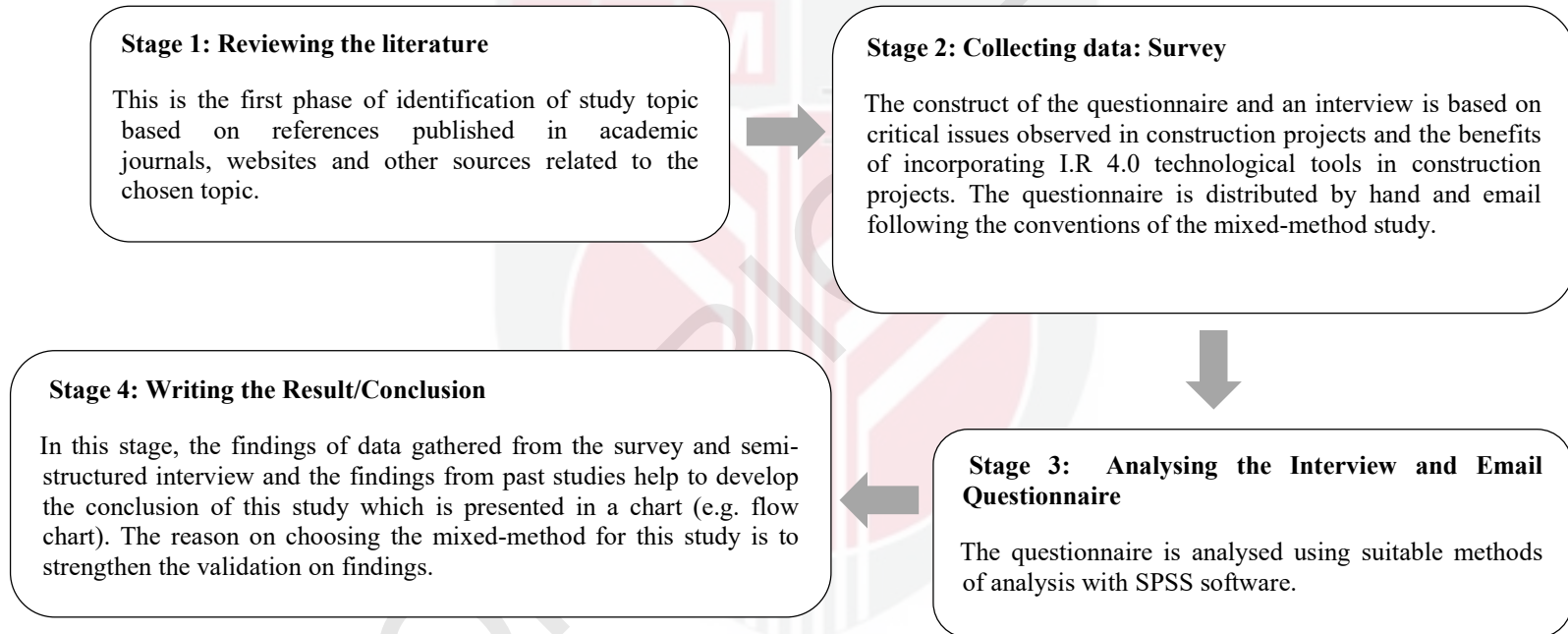


Figure 1.1 : Summary of the research according to stages

1.7 Scope of Limitation

This study intends to focus on the perception of Project Managers regarding issues in construction projects in both private and government sectors in the Klang Valley, Malaysia. This study, nonetheless, is limited to government projects. Project teams from the government sector that have been involved in construction projects, Government Link Companies (GLCs), private consultancy organisations and private contractors have been selected to participate in this survey since they have had the experience of working in government projects before. The respondents of this industry is actually huge, but only a few respondents agreed to participate in the interview and responded to the survey.

1.8 Contribution of Knowledge

This study contributes to the improvements in the construction projects based on three main issues in construction projects which are quality, safety and delay. The main contribution is particularly for construction projects in Klang Valley, but the findings can certainly be incorporated in other similar industries. It is an exposure to the construction projects to explore and develop the best solutions for the issues experienced in government and private sectors' construction projects as well as to shape an appropriate professionalism in both working environment and the system. Essentially, the findings of this study would benefit the Project Managers in building a better future in both government and private sectors' construction projects.

1.9 Study Chapter

This study is organised into six chapters. Each chapter focuses on an aspect of the study which is outlined as follows:

Chapter 1: Introduction

This chapter sets out the context of the study, the problem statements, and the reasoning for the analysis which formulates the basis for all subsequent discussions in the following chapters. The study objectives, priorities and study issues are also included in this chapter. In addition, limitation and constraint of the study are also illustrated in this chapter.

Chapter 2: Literature Review on Construction Project Issues (Quality, Safety and Delay)

Within this chapter, the discussion of the literature review emphasises on the contribution of GDP (gross domestic production) of construction projects, and how it gives impact to other industries. This impact somewhat affects the economic growth and the Industrial Revolution 4.0 (I.R 4.0) in other industries. This chapter also focuses on findings from past studies that discuss the issues related to quality, safety and delay experienced at construction projects. The identification of the types of findings will provide information on related issues to the project team. Furthermore, this chapter also focuses on discussing the role of project managers in general as well as within the context of Klang Valley construction sector. This chapter also describes and assesses the change of positions over a few years since the construction career started in Klang Valley. A detailed analysis of the positions taken from the literature is also described in this chapter. In the three separate classes such as government agencies, consulting firms, and construction firms, the role of project managers and the evolution of the position in construction projects in Klang Valley are discussed.

Chapter 3: Methodology

This chapter addresses the methods and methodology employed in this study and the analysis process of the gathered data. Hence, the details on the employment of the study methods and the justifications for the choices made at each stage are elaborated. This chapter also includes the methodological perspective of the study, methods and techniques used in the study.

Chapter 4: Qualitative and Quantitative Analysis

This chapter contains the review of qualitative data analysis results. It consists of the description of the sample from the semi-structured survey and the conclusion drawn from each segment of the survey. This chapter also focuses on the qualitative data analysis of the interview participants which uses Nvivo. This chapter also contains the review of quantitative data analysis results. It consists of the description of the sample from the semi-structured survey and the conclusion drawn from each segment of the survey. This chapter also focuses on the quantitative data analysis of the questionnaire which uses SPSS software.

Chapter 5: Discussion and Comparison of Findings

This chapter presents the findings from the analysis of survey and interview data. From the analysis, three themes emerge from the qualitative data that consist of:

- a) Theme 1: Issues at the construction projects;
- b) Theme 2: Technology implementation in solving the issues at construction projects;
- c) Theme 3: Benefits of I.R 4.0 in tackling the issues of delay, quality and safety in construction projects.

Chapter 6: Conclusion and Recommendations

The last chapter finally presents the findings of this study, the recommendations and suggestions for future studies. The results indicate that the purpose and goals have been achieved, the study methodology conducted has been validated, the conclusions drawn from the study are clear and accurate, and the contribution of the study is acknowledged with recommendations for future studies. Precise recommendations are made based on the conclusions drawn in accordance of the followings: exclusion, limitations, constraints, and restrictions.

Study process figure 1.2 highlighted on plan and the process of the fundamental and relation of the study and the result as the finding after the process need to be done. The table highlighted study methods and follow by analysis, findings/conclusion, contributions all the justification of study. This process is the flow from the literature review as the early study stage on identification of issues before the methodologies apply for data analysis process to be done. The findings from data information collection with conclusion after the result from the selective of data software will be applied for the test. After the procedure and receive the result, the contribution for the study will be identified along with the justification of the study.

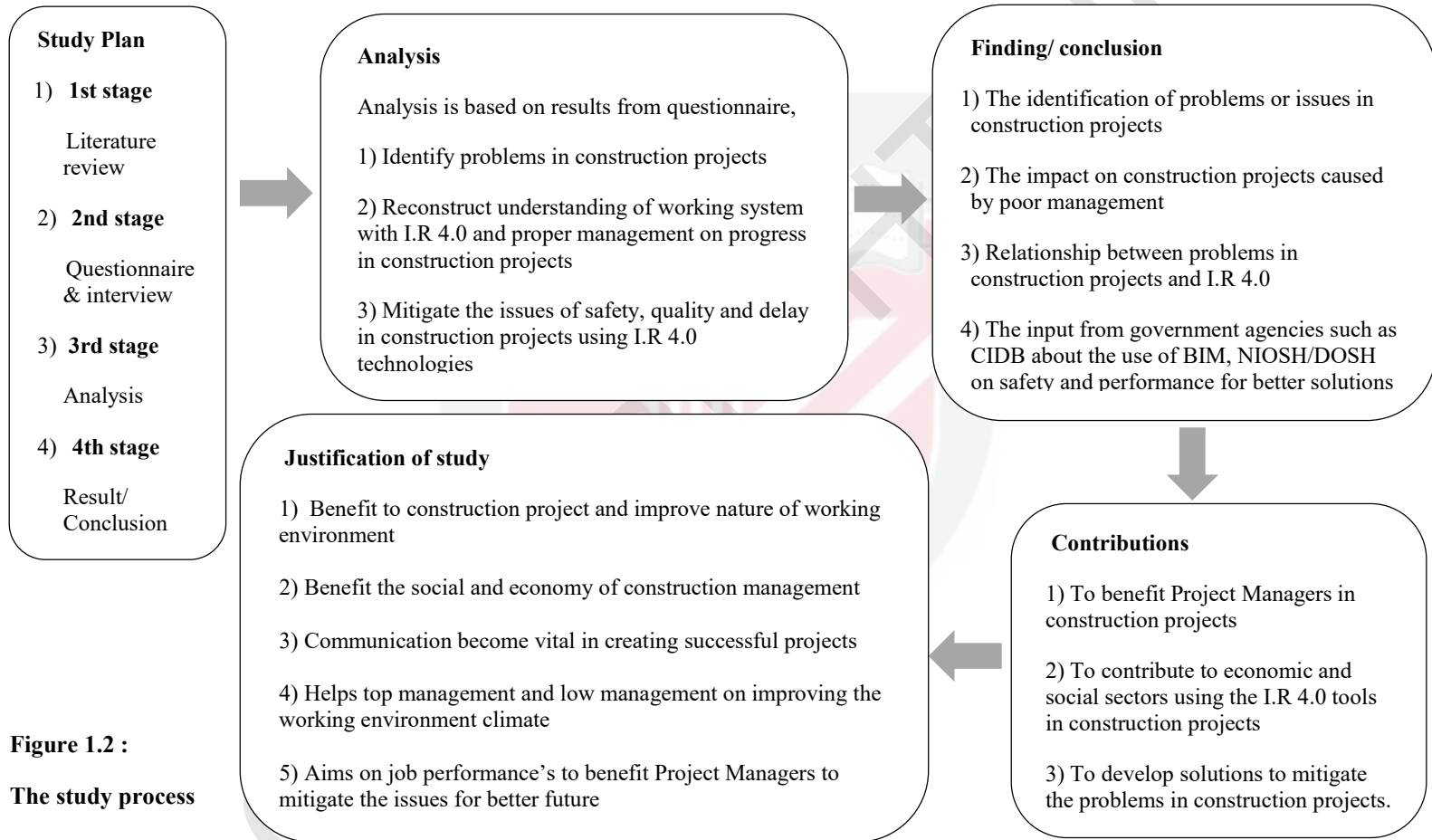


Figure 1.2 :
The study process

Refer table 1.1 for study on justification table where problem statement and objectives were highlighted to this study for development of next study question to be designed on getting the data information. The study question can only be designed after the findings from the problem which occur in construction project and later to identify the main objectives on solving the issues that could mitigate the issues in construction projects. After this process had been done, the direction will be more clear on how to build or design the study question for survey and questionnaire on getting the data information.

Table 1.1 : Study on justification table

Problem Statement	Objectives	Study Question
1) Various issues recurring identified in Klang Valley construction projects such as delay, quality and safety	1) To identify the types of issues that are commonly observed at construction site.	1) What are the levels of factors that contribute to the problems in construction projects?
	2) To investigate the methods to solve the issues observed at construction site projects.	2) What are the levels of factors that contribute to the problems in construction projects?
	3) To determine the mitigation methods to overcome the issues using relevant technologies of I.R 4.0 that match the type of problems to improve the working climate.	3) What are the benefits of I.R 4.0 tools, applications and software to the construction projects?

1.10 Summary

This chapter highlights of this study by focusing on issues that occur during construction period and solutions for mitigating the issues with the methodology and method input in summary to overcome the issues and to make a simple and easy thesis preparation. The summary of study methodology, contribution of knowledge and structured are presented in this thesis. The following chapter presents the two critical literature review related to the issues observed in construction projects by selected authors.

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