Barriers in Adopting Lean Construction Principle (LCP) in Selangor and Kuala Lumpur

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Research Project Submitted in Partial Fulfilment of the Requirements

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DECLARATION

I hereby declare that this project paper is the original study undertaken by myself unless stated otherwise. Due acknowledgement has been given to references quoted in the references. The views and analyses in this study are that of mine, based on the references made; and this does not constitute an invitationto use this study as a technical tool for management purpose.

Signature :

Name : **SITI ROSNAH BINTI SALMAN**

Date : 30 June 2022

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DEDICATION

I am very thankful to my family for giving me moral support until I able to finish this research project. I owe a great debt of gratitude, for motivating me throughout my journey of this research project, being understanding and encouraging me to go on and on not limited to this study, but for my overall life goals too. Therefore, this research project is a dedication to my beloved family:

Jasmee Bin Jamil (Spouse),

Amierul Hakim Bin Jasmee (Son),

Ain Nur Izzati Binti Jasmee (Daughter),

Ain Nur Airysh Binti Jasmee (Daughter) and

Ain Nur Insyirah Binti Jasmee (Daughter).

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BARRIERS IN ADOPTING LEAN CONSTRUCTION PRINCIPLE (LCP) IN SELANGOR AND KUALA LUMPUR

By

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The construction has a significant impact on global economic development. Construction of adequate buildings and infrastructures ensures that a country achieves specific goals such as social development, industrialization, freight transportation, sustainable development, and urbanization.

***Design/Methodology/Approach**: This study accesses the barriers of adopting LCP in Selangor and Kuala Lumpur. The quantitative research approach was applied with questionnaires survey feedback from construction various levels employees of construction companies in Selangor and Kuala Lumpur with sampling design of 100 (respondents who participated in this study). The construction companies were chosen at random based on category G7 on companies' listings on the Malaysian Construction Industry Development Board (CIDB) website, and content analysis was used to determine the main outcomes using SPSS software. Quantitative method was applied in this research to give a comprehensive approach and supportive of research outcomes.*

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CHAPTER 1

INTRODUCTION

1.1. Background of the Study

1.1.1. The Malaysian Construction Industry (MCI).

The economic growth of a country is linked to its prosperity, and all sectors, such as primary, secondary, tertiary, and quaternary, contribute to the economy's stability. The building industry is crucial because it represents the country's prosperity, health, and quality of Malaysians' life. Based on several factors as discussed below:

i. The MCI is the backbone of any country's economic growth, it has an impact on every sector's role at all levels of the economy. Developing countries rely heavily on the building industry to carry out their long-term development plans. In terms of money circulation, the building industry has a direct impact on social and economic development.

ii. The MCI plays such a large part in the economy, its influence on a country's economy is linked to forward and backward links with other industries. Because these ties to other sectors are based on improvement, any change in one of them will have a big impact on Malaysia's socioeconomic.

Comparison of GDP contribution among the significant available sectors in Malaysia such as services, manufacturing and agriculture sector within 10 years of period started from 2010 to 2020 is 54.8%, 22.7% and 8.5% respectively. Nevertheless, the construction sector does not categorize as the top 3 GDP contribution, with its value only at 4.3%, which is considered as low compared to other three sector mentioned earlier. Despite the small contribution to GDP of Malaysia, the construction sector has been tremendously growing for the past 10 years. As seen from the graph in Figure 1.0,

construction real GDP has increased from MYR 7,222 million in Q3 2010 to MYR 14,432 in Q3 2020, yielding a CAGR of 7.2%.

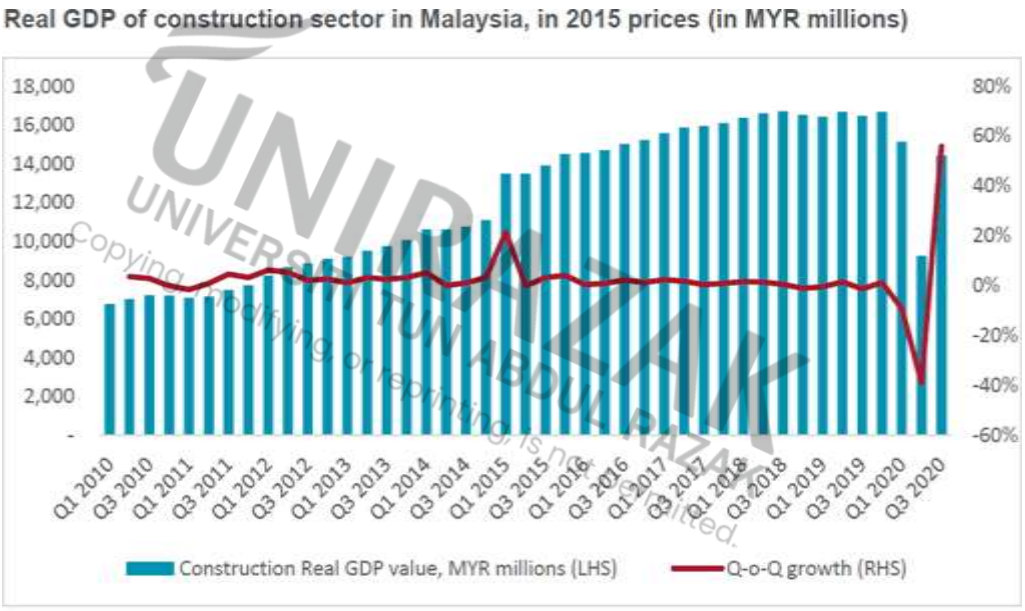
Department of Statistic in Malaysia claimed that the GDP of Malaysia contribution of over RM102.2 billion (US$32 billion) by the construction sector. The distribution of contribution is as below;

i. Commercial buildings: 34.6 %

ii. Infrastructure Construction :30.6%

iii. Housing Projects: 29.7%

iv. Others: 5.1%



Source: Department of Statistics, Malaysia (DOSM)

Figure 1.1.1. GDP of Construction Sector as of Q3

Construction sector not only plays a critical role in contributing to the country's economic growth, it also helps to improve the quality of life in Malaysia. In addition, the construction industry also contributes in generating employment within Malaysia's economic, thus there is lot of improvement demanded when we discuss about the aspect of safety problem on construction sites. Employees who were aggressively working in construction activities had a greater risk of death compare to other industries, according

to incident records.

Incident may lead affect an emotional and psychological impacts to families, which is caused unhealthy social communities, if the situation not in orderly control by the management, it would discourage workers from working in that sector, lead to non-sustainable construction due to man power shortage and bad impact to overall economy of the country. Statistics on occupational incidents are difficult in justification of safety and security of work place and working environments. Figure 1.1.2 Occupational incident statistic by sector until October 2021, the statistics show and indicate the range of workers' exposure risk and justify that construction is the most vulnerable sector to work with.

The Department of Safety and Health (DoSH) records refer to Figure 1.1.2 indicated the construction sector has recorded 56 fatalities out of 151 numbers of cases (reported to DoSH) in occupational accident statistic by sector until October 2021 and based on National Occupational Accident & Fatality Rate, a fatality rate average of 3.82 for every 100,000 from Year 2014 until Year 2020 as stated in Figure 1.1.3.

OCCUPATIONAL ACCIDENT STATISTICS BY SECTOR UNTIL OCTOBER 2021 (REPORTED TO DOSH ONLY)

SECTOR	NPD	PD	DEATH	TOTAL
Hotel and Restaurant	84	1	0	85
Utilities (Electricity, Gas, Water and Sanitary Service)	151	3	8	162
Finance, Insurance, Real Estate and Business Services	251	6	14	271
Construction	116	7	56	179
Transport, Storage and Communication	232	3	6	241
Manufacturing	3253	166	43	3462
Wholesale and Retail Trade	164	2	0	166
Public Services and Statutory Authorities	45	1	4	50
Mining and Quarrying	31	1	7	39
Agriculture, Forestry and Fishery	732	15	13	760
TOTAL	**5059**	**205**	**151**	**5415**

LEGEND:
PD - PERMANENT DISABILITY
NPD- NON PERMANENT DISABILITY

Source: International Policy and Research Development Division

Figure 1.1.2: Occupational Incident Statistic by sector until October 2021

Figure 1.1.3: National Occupational Incident & Fatality Rate as of Oct 2021

Figure 1.1.4: Statistic Trend of Incident and Fatality Rate Year 2010-2020.

Reported by Department of Safety and Health regarding the statistic trend of incident and fatality from Year 2010 – 2020 in Figure 1.1.4, it helps in estimating the policy makers in regards to the preventive action and safety campaign taken are soon as and effective as possible. This phenomenon had caused a wake-up call to all construction

players in their effort for minimizing and eliminating wastage of incident, besides enhancement of delivering value and quality at the end of the construction project. The construction sector characteristic naturally unique, high risk and one-off project, therefore the data from the statistic in general provide information of improvement.

In term of progressive state in construction sector work done in Q3 2021, as shown in Figure 1.1.5, taking the state of Selangor and Kuala Lumpur as a focal point in economic contribution towards Malaysia's economy, the state contributes a notable RM5.3 billion and RM4.7 billion respectively.

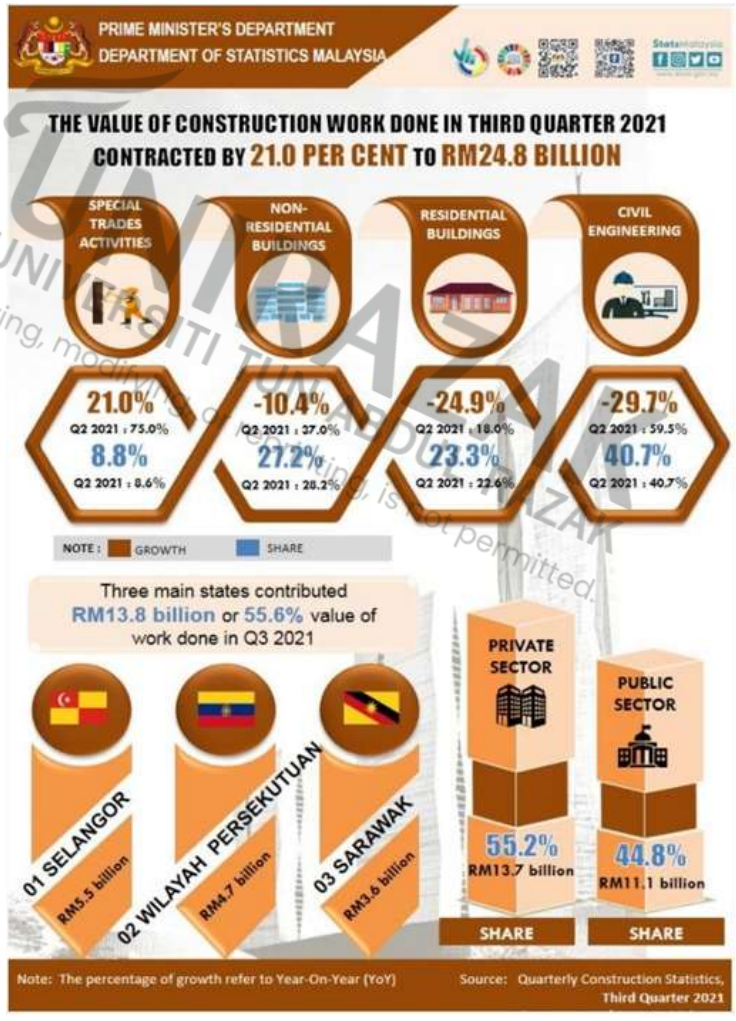


Figure 1.1.5: The value of construction work done in Q3 2021

1.1.2. Construction Safety.

As construction is one of the most dangerous work, construction safety is a major cause for concern in the working world. The purpose of construction safety is to ensure the construction site or the industry as a whole is not causing any immediate danger to the workers or public around a construction site. The Occupational Safety and Health Act and Regulation provides health and safety regulations and standard specific to the construction industry.

1.1.3. Lean Management.

Somewhere during the end of year 1950s, the automaker industry lead by Toyota had introduced lean management. Lean is a concept or way of thinking that focuses on eliminating waste, productivity increment and streamlining processes to save time, space, materials and budget consumption. It came as a discipline in the lean production concept and is believed to first be adopted in construction industry of United State and known as LCP in 1992), targeted to minimize waste in the construction projects. Right after the publishment of the book of (Womack, Jones, Roos, 1990) “The Machine that changed the World” and “Lean Thinking”, respectively, Lean has gained attention among the industrial players.

1.1.4. Lean Construction Principle (LCP).

Lean construction has been viewed as an effective management approach for reducing the occurrence of no-value activities, such as wasting resources and safety-related incidents. These findings provide new insights into the use of lean construction for construction safety through the implementation of Lean Construction Principle (LCP). The LCP provides a driving force for the implementation of safety management planning

and enable employees to participate in safety activities, which enhance their responsibility and promote motivation in compliance with safety regulations. Besides that, LCP primarily influences the management, employee and environment system of construction site. By implementing LCP, an organization will secure a better health and safety environment and accomplish in sustaining growth and profitability the organization itself. This research will be focusing on the importance of LCP in construction safety and study in detail about the possible barriers hindering in order to improve safety in the construction site.

1.1.5. Construction Company Grades Classifications by CIDB Malaysia.

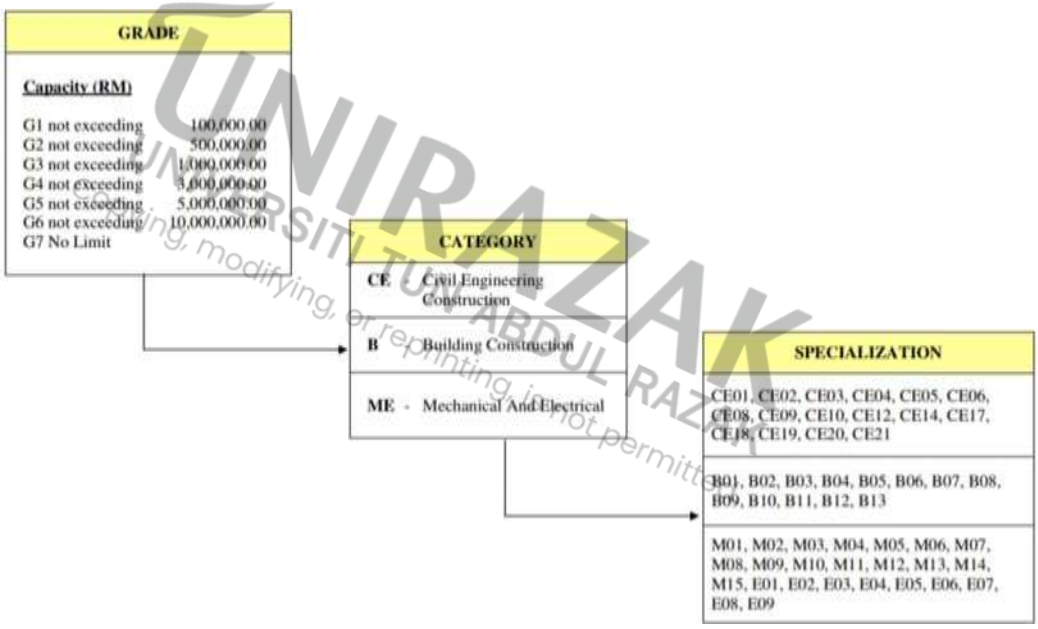


Figure 1.1.6: CIDB Grades Classification

This paper aims to LCP implementation issue in Malaysia Construction industry. Data was obtained from G7 contractors registered with the Construction Industry Development Board (CIDB). A CIDB grading is a rank given to a construction company based on the value and experience of the previous construction projects. The rank is based on works, financial and general compliance criteria as shown in above figure 1.1.6; CIDB Grade Classification.

1.2 Problem Statement.

Majority incident in construction site could result in minor and major injuries which might cause fatality or disability either permanent or non-permanent. In an effort of Malaysia's government to improve the safety and health Improvement in construction industry, the government had launched various campaigns, initiatives and studies on different methods and practices have also proposed.

Although, various initiatives at the best level of current management system have been implemented and beyond the yield of construction safety record, yet incidents still occur, therefore still severe gaps in safety problems to be identified in Malaysia construction industry. Nowadays, with the technology development, the issue of incident prevention through innovation and software on construction site has become significant, as an example LCP as a baseline to improve safety through innovation of IBS, BIM or E-documentation by using Artificial Intelligent approach. This is how the potential impact of LCP techniques such as workers' involvement in delegating task and scheduling, clients' and workers' participating in making decision, workplace organization and forecasting play major factor towards the reduction rate of fatality on construction sites.

Despite the technological advancements, government's agency like CIDB also played major roles in ensure compliance with the LCP requirement. Government has yet to introduce this LCP as a policy in managing a construction site, and no enforcement or regulation in adhering the system in construction process flow. This phenomenon, therefore has led to the issue of lacking in commitment from construction practitioner to implement LCP and obtain the best result. There are also found a significant gap between the theory and implementation of LCP in MCI due to lack of understanding of LCP concept, inadequate training to upgrade their knowledge, skills, techniques and process. In Malaysia, MCI still maintain as the main contributor to severe and fatal incidents and LCP is still far behind as viable

mechanism to overcome the problem. As we know, LCP is known as principles focus in value improvement and waste minimization. In LCP define work incidents and injuries as major source of waste with consequences of hidden higher costs. The cost rises due to the consequences of variability of construction and workflow disruption upon the occurrence of such incident. Therefore, it is vital for all members of MCI to play major role with fair commitment to participate in lean management processes and be effective in reducing injury-related construction incidents and improving labor Improvement. As a result, MCI have pushed for designing and developing enhanced safety programs to control the aforementioned problem, but the challenge remains in applying the LCP throughout the construction process to bring benefit for better quality of end products and better safety in the construction site.

1.3 Research Objective.

This study is objectively to assess the barriers faced in adopting LCP to improve safety of G7 contractors located in Selangor and Kuala Lumpur. The LCP that has been selected to be focused in this study as previously mentioned are Prevention through Design, Last Planner System, Visualization and 5S. However, the team might face challenges during the implementation of LCP during the process flow process which might lead to the occurrence of incident. Therefore, the research objectives stated as below we aim to achieve:

a. To analyze the impact of LCP implementation towards safety improvement to G7 contractors in Selangor and Kuala Lumpur.
b. To analyze the factors which might cause unsuccessful in adopting LCP to improve safety by G7 contractors in Selangor and Kuala Lumpur.

The mixed method of data collection through literature review, CIDB Database, Department of Safety and Health Database, Department of Statistics database, questionnaires and multiple analysis methods were used to achieve the target the research objectives. The quantitative research method by survey questionnaire was used in this study to gain opinion and real data from the respondents. The qualitative research methods through database and literature review were used to assess the previous data and support the data findings from the quantitative research.

1.4. Research Questions

The research questions that are needed to be asked and hoped to be answered based on the findings and data collecting are:

1. Is your organization aware about LCP.?
2. Does your organization implement Prevention through Design (PtD) at your construction sites before commencing work?
3. Does your organization implement Last Planner System (LPS) at your construction sites before and during commencing work?
4. Does your organization implement Visualization System (Signages and warning system) at your construction sites?
5. Does your organization implement 5S(Housekeeping system) at your construction sites?
6. Does your organization aware that LCP can improve safety at your construction sites?
7. What are the barriers in adopting LCP to improve safety at construction sites?
8. How is the lacking of commitment management and stakeholders has affected adoption of LCP ?
9. How is the financial constraint has affected adoption of LCP?
10. How is the lacking of knowledge and technical skill has affected adoption of LCP?

11. How is the lacking of government support has affected adoption of LCP?
12. How is the LCP has improved safety in your organization?
13. How do you think the Government could assist in reducing the barrier in adopting LCP to improve safety of the G7 Contractors in Selangor and Kuala Lumpur?

1.5. Significance of the Study.

The construction industry contributes significantly to the country's economic health and growth. Wasted in construction projects due to incident would cause adverse effect to the company's Improvement, corporate image and overall effect on the economy.

Building projects experienced adverse effects due to the numerous numbers of severe incident and potential to be failure in competition in our global market. Therefore, identifying the underlying root cause of incidentcan provide the best solution for minimizing the effect of the incident or safety problem through the application of LCP during the process of construction. As such, the significance of this study is to identify the barriers or problems which might lead to the failure of LCP as mechanism to reduce the safety problems in the construction industry of Malaysia.

1.6. The Organization of the Study

This research is divided into 3 (three) categories where the first chapter would be consisting of background of the study, problem statement, research objectives, research questions, the significance of the study and followed by the organization of the study. Next, the chapter 2 (two) is the literature review consisting of its own introduction, theoretical foundation, empirical research, proposed conceptual framework, hypothesis development, and the summarization of the whole Chapter 2 (two).

In Chapter Three (3), after the introduction, the author will elaborate on the research design, the sampling size and procedures, how the data are collected and operationalized and measurement such as the use of all type of variables which is included independent variables, mediating variables, and dependable variable, data analysis techniques based on descriptive analysis and inferential analysis technique and end up with the summary of Chapter 3 (three).

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CHAPTER 2:

2.0 LITERATURE REVIEW

2.1 Introduction

Construction industry members consist of developers, designers, contractors, subcontractors as well as supply chain vendors. The implementation of safety management in those companies in order to prevent incident and comply with safety regulations. However, these safety regulations only formally structure and practice by the contractors, therefore, compliance as a single industry player lead to inefficient move to eliminate incidents and assure a completely safe environment in the project.

2.2 Theoretical Foundation.

Malaysia is a developing country that is still recovering from a COVID-19 Pandemic, the industry is expected to have registered positive growth by a reduction of severe cases of Corona Virus diseases (COVID-19) during the final quarter of 2021. According to Global Data, Malaysia construction industry is expected to expand by 16.5% towards Endemic phase by 01 April 2022, supported by the government's focus on completing large infrastructure projects, and increased investment industry and energy projects. Besides, Malaysian government has allocated budget of MY332.1 billion for development expenditure, inclusive incentives for employment rates and support business improvement.

The MCI driven by the largescale transport and energy projects were expected to register an annual income average growth of 6.2% between 2023 and 2026. In addition, with the announcement of government to establish the Public Private

Partnership (PPP)3.0 model, a specialized mechanism to fund infrastructure projects between 2021 and 2025.

2.2.1. Lean Construction Principle (LCP).

LCP is needed to enhance a safe working environment through an improved construction process. Poor safety is considered as a form of waste on construction sites, since injuries will be costly on several levels of the process such as: human sufferance, compensation costs, lost time, lost productivity, and higher employee turnover (Nahmens 2009).

Some researchers developed an interaction matrix between LCP and safety management practices to further understand the underlying relationship. The results indicate evidence of the interaction between lean production practices and safety management practices (Antillón et al. 2011). Thus, using lean concepts may be useful to guarantee a safe working environment in construction sites (Basher 2011).

2.2.2. LCP Awareness.

These tools are selected because they are major tools in implementing to improve safety in construction site. These tools also known as embodying LCP besides they are the crucial to be implemented, and they represent basic lean knowledge that can be later focus on:

i. The Prevention through Design (PtD),
ii. The Last Planner System (LPS),
iii. Visualization, and
iv. 5S(housekeeping)

The objective of this paper is to examine the barriers in adoption of LCP to improve safety by G7 contractors in Selangor and Kuala Lumpur. The first part of the paper will explore the LCP practices and their relation to safety and the impact on safety conditions in construction projects. The second part studies the barrier in adopting LCP to improve safety of G7 construction site in Selangor and Kuala Lumpur. Lastly, the third part will focus on recommendation and strategies should be taken to ensure the implementation of these LCP and the effectiveness in improving safety of construction site by G7 Contractor.

i. Prevention through Design (PtD):

Defined as a process of addressing safety and health needs during design stage through anticipation to minimize and prevent hazard and avoid risk. The Prevention through Design studied and presented by Michael Mills during the 17th LCPI Congress in Boston USA, focus on the design characteristic that must be out of risk. This attempt is important to eliminate waste which lead to risk. Prevention through Design collaborates process that involved front line workers, through engagement of all members from architects, designers, engineers to contractors.

On the other hand, according to Howell et al.(2017), there are two basic ways to prevent injuries: (1) prevention through design, and (2) prevention through task planning. In other words, improving product design and construction planning can play a decisive role in preventing incidents in the project. Abdelhamid and Everett (2000) proposed a model for identifying the root causes of incidents which could provide a template for systematic and rapid determination of areas requiring more investigations, so that labor and management may put more effective measures in place for preventing probable incidents. Gambatese & Hinze (1999) indicated that the use of knowledge of construction workers and designers in the early stages of a project can be a positive step towards improving safety Improvement. Huang (2003)

showed that Design-Build contracts have better safety practices, since in these types of contracts, the contractor and the designer play on the same ground, and the design team has more motivations to devise safe plans in the design phase.

ii. Last Planner System (LPS):

Defined as supervising activity in making decision of what work is to do on the next day as claimed by (Song et al., 2008). Practically, at the best level of practices, there is requirement in developing a weekly plan of work (Ballard 2000; Song et al., 2008). This attempt is important towards the reduction of excessive stress and pressure on site organization. This has been clarified by (Suraji et al., 2001; Loughborough and UMIST 2003; Haslam et al., 2005; FISCA 2006).

Kamata (1982) and Fucini and Fucini (1990) also claimed LCP system had deprived workers of freedom. According to (Saurin et al., 2006; Mitropoulos et al., 2007). the LPS approach helps in reducing the likelihood of incidents occurrence through the justification on workers' capability requirement with the tasks demands if training or skills needed during planning stage. The LPS helps in empowering workers by delegating the tasks accordingly and methods which is suitable with workers abilities. The LPS approach using the work program in controlling the construction process by forth-nightly and monthly meeting, in order to avoid hazards which cause of risks occurrence. Nahmens and Ikuma 2009). Initially HIRARC) is identified the different risks and hazards and effective safety measures., prior to commencing of construction process, hazard identification and risk analysis and risk control.

During safety management plan, various aspect safety could be improvised by choosing the right and suitable safety construction method statement including equipment and material use(Sacks et al. 2005). He also stressed on workers ability with the methods and ensure provision of proper equipment for construction process must be given attention by the management. This is because the factors of human,

method of work and equipment had caused incident and required supervision. The LPS approach which is focused on the six-week look ahead stage, therefore planning must be carried out in advance of one or two months, it is important for the safety personnel in establishing a plan for supervision schedules in an attempt to avoiding incidents occurrence (Sacks et al., 2005).

iii. Increased Visualization (Warning and Signages).

Ensuring visibility is important as safety measure by creating work environment condition clear and safer for the employees (Salem et al., 2007). Saurin et al., (2005) and Fewings (2013) identified that management of visual system plays the vital role in practicing safety on the construction site. Visualization is useful in communicating any information to workers such as warning signage, picture of reminder, safety signage or safety devices in order to increase the workers caution and awareness, thus the tendency of incidents occurring could be reduced. Sawacha et al. (1999), FISCA (2006), Tyler and Lamont (2008) and Donaghy (2009), concluded that the main reason of incidents on construction site are due to lacking in communication, lack of knowledge and safety awareness. Kletz (1993), Sawacha et al. (1999), Suraji et al. (2001), Howell et al. (2002) and FISCA (2006) highlighted, an incident may happen due to poor or unsafe condition of workplace and unorganized layout. Visualization improvement is important as it would helped in reducing the incidents caused by slipping, tripping and falls (Hughes and Ferrrett 2008).

Transparency in visualization which mean visible working environment is also important towards the reduction cause of incidents at workplace. As stated by (Sacks et al., 2009). However, due to the nature of construction sites, at certain time and location it is not easy to apply this approach of visualization effectively such as auto alarm prior to such incident happen. As an example, hazards such as fatigue and dehydration which are invisible and unable to interpreted. Therefore, data on

safety Improvement may be hardly collected by using the visual devices (Saurin et al. 2006). This visualization tool may also require to be applied consistently with other tools towards effective safety control Ikuma 2009).

iv. The 5S (House-keeping).

LCP tools correlate the 5S approach which comprising of 5 elements of Japanese terms for **"seiso", "seiton", "seiri", "seiketsu" and "shitsuke".** The approach is also known as housekeeping, cleanliness or tidiness of workplace. Sawacha et al. (1999), Suraji et al. (2001), Haslam et al. (2005) and FISCA (2006), a non-organized construction is one of the reasons of incident such as tripping, electrical shock, falling from height, problem in access and ingress.

Seiso suggests that materials/ items and machines which are not intended to use should be arrange out of site (Bicheno 2000). This LCP technique helps in preventing any unused materials and machineries or equipment congestion which cause of obstruction and lead to an incident, also known as incidents causal (Howell et al., 2002; HSE 2009)

Seiton, is defined as proper arrangement. In construction site, there are many and various kind of machineries, equipment and materials required to be stored at designated storage according to the layout for easily retrievable system at the workplace (Abdelhamid and Salem 2004). In aspect of the construction sites safety, this means that machineries and materials arrangement must be organized at the most appropriated location with proper access of movements, circulation and obstruction thus help in avoiding incidents.

Seiri the term defined as clear from unnecessary items during the process. Practically, the construction sites should be cleared of unnecessary materials in order to clear access and egress from any obstruction and safer movements. This effort may avoid the consequences of tripping, falling from height and hit by

machineries during construction process, (Salem et al. 2007; Nahmens and Ikuma 2009).

Seiketsu the term defined as maintaining the tidiness of workplace according to the layout of on construction sites. This approach focuses on safe condition and clean environment according to (Abdelhamid and Salem 2005). Unsafe condition on construction sites, is key factor of incident (Sawacha et al 1999; Toole 2002).

Shitsuke, the term defined in construction as safety continuous improvement culture among the workers (Bicheno 2000). Housekeeping help in keeping overall site condition in good condition, well-organized could help in making the site more hygienic and reduce the potential of health effect during the Pandemic of Covid-19. Finally, Fucini and Fucini (1990), Green (1999) and Rehder (1994) have correlated the LCP to minimize improper traffic control issues, eco-system impact and to unsafe condition, it proven that the 5S approach is effective in protecting workers exposure from such incidents (Narang and Abdelhamid, 2006 and Bae and Kim, 2007).

Recently “Five S” was modified to 6S (the above mentioned “Five S” and Safety) to give importance to safety at the workplace (Anvari A. 2011). “Six S” implementation in the construction industry would be beneficial with the addition of safety, as this industry suffers from weak implementation of safety protocols, especially in developing countries.

2.2.3. Categories of Barriers.

This study focuses on the barriers in adoption LCP to improve safety in construction projects which is categorized and explain as below:

i. Lack of management and stakeholder support
ii. Financial constraints
iii. Lack of educational and technical skills.
iv. Lack of governmental support.

v. Bad human attitudinal

i. Lack of Management and Stakeholder Support.

Management barriers are referred to various issues related to the support of the top management as claimed by Abdullah et al(2009). Attri, R., Singh, B., & Mehra, S. (2017) and Small (2017), strongly suggested that the successful implementation of LCP or any new innovative strategy needs to be supported by top management. Management support and commitment is a key factor potentially enhancing or hindering the effect of Lean tools on safety improvement Camuffo (2017). Poor project definition is proved to be a management barrier prevented the successful implementation of LCP in construction projects, Oladirann(2008),O Small,E(2017), Ayarkwa(2012), Bandy(2011). Many of LCP techniques are used to promote safety in construction projects like conducting a pre task hazard analysis and defining standard procedures to maintain clean work environment Cudney,L (2015) and Sacks,R,(2009). Conducting a critical task planning to study the task and review the work methods to identify the appropriate method that matches with workers' abilities is also identified as LCP technique to improve safety in construction projects, Bashir, H(2013) and Mitropoulos(2007).

A single authorization is not recommended in making decision while practicing LCP. Job delegation should be divided equally by the top management among the project team including client, designer, consultant, main contractors and subcontractors and expertise from workers team member are allow to participate in making decision which lead to enhancement of process work flow, it has been stated by Camuffo(2017), Oladiran(2008), Bandy(2011) and Alinaitwe,(2009). Abdullah, S. (2009), Bandy(2011), Alimaitwe(2009), Zhou, B. (2012), AlSehaimi(2009), Mossman, A. (2009) found in their research agreed that factor insufficient time allocate by the management to the team to innovate ideas and support their efforts in implementation of LCP in construction projects. Enshassi(2009) defined that some management tends to put on pressure

among the contractors which create negative thinking that safety is time consuming and extra effort to comply during the process flow. The top management play a vital roles through providing long term plan , and absence of this aspect may lead to the failure of implementation of LCP, as identified by many researcher such as Bashir(2013), Bashir, A, et al(2010), Bashir, A, et al (2015), Small, E .et al(2017), Small, E,et al(2009), Mossman, A. (2009), Ogunbiyi, O. (2014), Shang, G. & Pheng, L. (2014), Fernandez-Solis, J(2013), Al-Aomar, R. (2012). Other researcher such as Cano, S.et al(2013), Attri(2017), Small, E., et al(2013), Alinaitwe,(2009), Alinaitwe (2009), Sandeep, R. et al(2016), Dave, B, et al(2015). also stressed on an adequate planning by top management to implement LCP. Enshassi(2014), Salem, O et al(2014), Bashir, A. et al(2011) considered lacking of planning as a barrier that hindered the implementation of LCP in construction projects. Salem, et al(2014) declared that one of the most important LCP tools is Last Planner System which mainly aimed to replace the optimistic planning with realistic planning based on workers' abilities inadequate planning will impede the application of LPS to replace the optimistic planning with the realistic planning. Other researcher such as Small,E. et al(2017),Alinaitwe,H.(2009), and Sundquist,V et al(2017). also found that logistics' problems like poor management of materials, equipment and tools and short supply of material are the factors of barriers that hindering the LCP implementation in construction projects. Some other researcher such as Bashir, A. (2013), Enshassi, A et al(2014), and Abdul Malek, F & Rajgopal, J. (2007), they described that poor management of material resulted in hindering the application of 5S tool which focused on organizing the workplace.

LCP team whom are lacking in transparency prevent the successful of in construction project as agreed by Alinaitwe,H et al(2009), Awada et al. (2016), Alarcón et al.(2011). This factor would cause of communication breakdown which prevent the efficiency of by the team member and stakeholder, whereby it is required effort from the team member to coordinate and cooperate, therefore lacking in those spirit may hamper the implementation.

ii. Financial Constraint.

Typically, the most common issues in LCP is financial problem that preventing the organization from implementing in the process flow. This topic has been identified by few research in various countries by Bashir (2013), Bashir, A. et al (2015), Sarhan & Fox, (2013), Wandahl (2014). Prior to the implementation, the company required to engage Lean Specialist or consultant in providing guideline for effective implementation LCP for safety improvement. Therefore, the provision of capital or budget is play vital role towards the successful implementation of LCP through providing relevant resources and fund for incentives and reward systems. This factors clearly described by most of researcher such as Cano, S.et al(2013), Bashir, A. et al(2015), Small, E. et al(2017), Enshassi, A., & Abu Zaiter, M. (2014), Porwal, V. et al (2010). Unfortunately, Small, E. at al (2017) found that low tender prices by contractors in winning the bidding also play a role in hindering the implementation of LCP. The provision for training cost and hiring consultancy company are considered as implementation cost of LCP in construction projects according to Oladiran(2008). This phenomenon described by many researcher such as Bashir, A. et al(2015), Oladiran (2008), Alarcón, L. et al(2011) and Sandeep & Panwar(2016), as a financial barrier impeded the implementation of LCP in construction projects. Furthermore, Oladiran (2008), Small, E., et al(2017), Ayarkwa, J.et al(2012), and Marhani, M. et al(2013) found that factor of low wages of professionals in construction industry discourage them to apply any innovative strategies as part of LCP activity.

Another factor which hindering the LCP is due to lacking in motivation and incentives in practicing LCP in construction projects according to many researcher such as Attri, R., et al(2017) and Sandeep& Panwar(2016). The unsafe and traditional behavior can only be changed by imposing incentive. As an example, in enhancing workers to be more concern about housekeeping, they need motivation and incentive since workers are used to work progressively however they neglected the work place cleanliness which

lead to messy environment after throwing so much garbage on the ground. Situation is getting worst when Oladiran(2008) identified corruption and inflation also one the factor that prevent the effectiveness of LCP. Oladiran, O. (2008) and Ayarkwa, J., .et al(2012) found that corruption, which includes bribery, extortion and fraud, may damage the implementation of LCP by resulting in overpricing of projects, using of inferior materials and poor workmanship.

Ayarkwa, J., et al(2012), Alinaitwe, H. (2009)., and Salem, O. et al(2005) found the reason of this issue is due to unsafe markets condition for construction which lead to the increased budget cost of the project and contradict to the main benefits of LCP in reducing cost.

iii. Lack of knowledge and technical skill.

According to Wandahl(2014) and Ogunbiyi, et al (2013) educational barriers could pose a great threat to the implementation of LCP. This opinion is also supported by Awada, M et al (2016) though that lack of understanding of Lean concept and inadequate knowledge of LCP are cause by educational barriers. Lean Concept is commonly known from manufacturing sector according to Abdullah, S et al (2009) and transferring the concept into construction is challenging due to lacking in technical skills in construction projects as been described by Bashir (2013) and (2010), Small, et al (20117), Fernandez-Solis, J. et al (2013), Porwal, V.et al (2010). Sacks, R.et al (2009) shared it in an example of lacking of technical skills hindered the conduction of HIRARC Hazard identification and risk analysis and risk control and incidents investigation program which are LCP techniques used to promote safety. Besides that, Bashir, A.et al (2016), Attri, R. et al (2017), Mehra, S et al (2015) conformed that lack of education and training; and lack of awareness programs is vital to be developed to overcome the educational barriers to the successful implementation of LCP in construction projects. Then, followed by Bashir, A.et al (2015), Alarcón, L.et al(2011) and Dave, B.et al(2015) stressed that

experiences and information sharing is another factors that prevent educational barrier towards the successful of the implementation of LCP in construction projects.

It is undeniable by the statement of Koskela (1992) that technical barriers have a direct impact on the application of certain LCP and tools such as reliability, simplicity, flexibility and benchmarking. projects Small, E. et al(2017), Alinaitwe (2009)concluded in their research that lack of agreed implementation methodology to implement LCP is identified as technical barrier prevented the successful implementation of LCP in construction. Furthermore, Bashir (2015), Gade (2016) described that the complexity of concept is another barrier LCP implementation in construction projects. In construction, the longer implementation period is needed to the successful of implementation of LCP in construction projects as concluded by Small, E. et al(2017), Sandeep, R. et al(2016), Adegbembo, T et al(2016) but Bashir, A et al(2015) mentioned that time is insufficient to train the workers on LCP, apply its principles, select the appropriate LCP techniques to use and implement them on site, manage change to working culture, and carry out an evaluation to identify areas for improvement. According to Koskela (1992) and Alinaitwe(2009) the factor of incomplete design also related barriers to implement successfully in construction project. Bashir, A .et al(2015), Small, E .et al(2017) mentioned in their research that the strategies of Improvement measurement and fragmented nature of the construction industry need to be upgraded cause the poor of this technical barriers can lead to the failure of implementation of LCP in construction projects. In addition, Cano, S.et al (2015), Marhani, M., et al (2013) defined the importance of integrity of the production chain including client, materials' suppliers and subcontractors must be sustainable to avoid barrier to the implementation of LCP in construction projects.

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iv. Lack of Government Support.

As a policy maker, government agencies play a vital role in shaping the future of safety through LCP. Bashir, A. et al (2015) stated that LCP implementation might failed due to nonsuppurative government and bad attitudes towards the construction industry in some countries. The bad etiquette related to the government bureaucracy and instability policy also play major roles in influencing the success of LCP as concluded by Oladiran(2008) and Small, E.et al (2013). Bashir, A. et al(2013), Small, E.et al(2017), and Ayarkwa, J. et al(2012)claimed that inconsistency in policies was identified as government barriers to the implementation of which has major effects on the plans of construction firms. Bashir, A., et al(2015) and Oladiran(2008) discovered that another factor of unsteady price of commodities also prevented the implementation of in construction projects. Commodities needed in construction projects to improve safety are safety equipment as PPE, signs, boards, demarcations and alarms which are considered as LCP techniques to promote safety. Bashir, A.(2010) consistently mentioned that the financial barriers like inflation, professional wages, and corruption practices could also be effected by government issues.

V. Bad Human Attitudinal.

According to Bygballe and Swärd (2014), human attitude is one of the major factors affecting the implementation of LCP in construction industries. Concluded by Oladiran(2008) and Mossman (2009) identified selfishness among professionals to provide their experience of the LCP implementation as a human barrier prevented the successful implementation of LCP in construction projects. Moreover, poor leadership is proved to be among the human barriers to LCP implementation in construction projects Bashir, A. et al(2015), Attri, Ret al(2017), Porwal, et al(2010). Lack of leadership may result into introduction of other barriers like employee resistance to change, inability to

change the organizational culture and poor communication as defined by Sandeep (2016).

In addition, cultural issues are also mentioned as barriers to the successful implementation of LCP in construction projects Cano, S.et al(2015),Sandeep, R (2016). Moreover, Alinaitwe, H. (2009), Alarcon, L (2002) emphasized that lack of self-criticism limited the capacity to undergo lesson learn session from the errors which hindered the successful implementation of LCP in construction projects. Many researcher such as Bashir, A .et al(2015), Mossman.(2009), Alarcon(2002), Sarhan(2012)thought that the feeling doubt of unfamiliar practices is another barrier to the implementation of LCP due to the misconceptions and misunderstandings of workers and some clients about LCP as described. Last but not least, Bashir, A.et al(2015) and Porwal, V .et al(2010) described that teamwork is important to ensure prevention of barrier impedes the successful implementation of LCP in construction projects.

2.3. Empirical Research

For this exploratory study, both quantitative and qualitative research methods willbe used to gather the needed data.

(i) Survey research

Number of employees from selected companies will be distributed questionnaire. This method hopes to receive a high response from the participants. The questionnaire will be distributed to the participants by simple online link through multiple social media channel such as WhatsApp and google links,

(ii) Correlational research

This method will be used to find the relation between two sets of variables. Regression is generally used to predict outcomes of such method. Thus, it is

believed that the outcome would be either positive, negative or neutral.

(iii) Causal-Comparative research

This method is based on comparison. It will be mainly used to find the cause-effect relationship between the variables. The employees' motivation level would be measured as a respond to the racial discrimination.

(iv) Case Study

As this research have some limitation, some extra information would be collected by carefully analyzing the existing research.

2.4. Proposed Theoretical Framework

The aim of the study is to analyses the impacts and challenges of LCP to improve safety in Malaysian construction industry. Hence, the outcome of the study could be either positive, negative or neutral. Based on a few previous researches that was done, it can be confirmed that the LCP has a positive impact on construction industry.

Since LCP obviously yet to be implemented in Malaysian Construction Industry, furthermore there has been similar research on the impact of LCP in Malaysia, it cannot be confirmed that the correlation between impact and barrier of hindering to improve safety in LCP of Malaysia especially in Selangor in other researches. If the outcome of the research turns up to be positively inclined, then it can be concluded that the LCP has no impact and its barriers do not hindering the safety Improvement of construction sector in Selangor and Kuala Lumpur.

If the outcome of the research turns up to be negatively inclined, then it can be concluded that, like other research studies done before this, the LCP has positive impact on safety Improvement and there are barriers were hindering the safety

Improvement of construction sector in Selangor and Kuala Lumpur.

However, should the outcome of this research turn up to be neutral, then it can be concluded that the LCP did not give any negative nor positive impact towards safety Improvement of construction sector in Selangor and no further discussion on the barriers hindering to improve safety to be analyzed in this research.

2.4.1. Conceptual Model for Barriers in Adopting Lean Construction Principle (LCP) In Selangor and Kuala Lumpur.

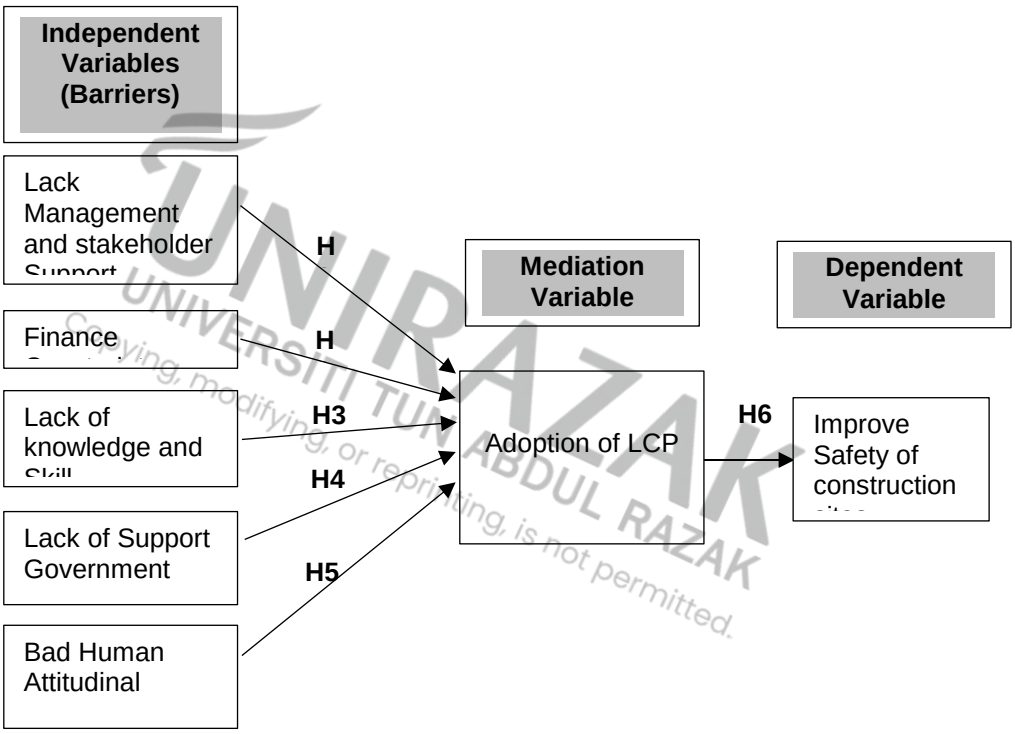

Figure 2.1: Theoretical Framework

2.5. Hypothesis Development

In this research the impact of LCP of construction industry organization would be integrated with the barriers in order to improve safety within the industry particularly in Selangor and Kuala Lumpur. Thus, the following hypothesis are developed based on the Conceptual Framework as shown in figure above.

H_1: Lack of Management and Stakeholder Commitment impacted the adoption of LCP to improve safety of construction site in Selangor and Kuala Lumpur.

H_2: Financial constraint impacted the adoption of LCP to improve safety of construction site in Selangor and Kuala Lumpur.

H_3: Lack of knowledge and skill impacted the adoption of LCP to improve safety of construction site in Selangor and Kuala Lumpur.

H_4: Lack of Government support impacted the adoption of LCP to improve safety of construction site in Selangor and Kuala Lumpur.

H_5: Bad human attitudinal impacted the adoption of LCP to improve safety of construction site in Selangor and Kuala Lumpur.

H_6: Adoption of LCP impacted safety improvement in construction site by G7 Contractors in Selangor and Kuala Lumpur.

2.6. Summary of Chapter 2

This section focuses on the creation of a theoretical framework based on the problem statement and research goals set out in this research. Prior to actually proposing a conceptual framework, the theory that applies to study goals and research questions is discussed in depth in order to prevent any misleading details and the conceptual framework has also been formulated in such a way that the sequence can be interpreted and believes that it is the correlation between all of the variables or the definition.

In the field of empirical analysis, the researcher aims to include as many information as possible of past research related to the subject of study through previous research on the subject related to this research. The results of the previous research and the field of their analysis will help the researcher look at which area of the study needs to be improved and how the study has been done on this subject, and what area of research draws past researchers to study and why they concentrate on it.

The evaluation of previous studies is also relevant to address the actual challenges faced by construction industry and also analyze how companies that was studied previously steered through the pandemic. The creation of hypotheses that the researcher generates in this context is appropriate for its function, can also be tested and can also be directional and non-directional. This is not a matter of concern in this field, as researchers understand the needs and requirements of this hypothesis of standard procedures. It allows the researcher to go step-by-step in this research without jumping to a conclusion, andevery department of this research, such as every aspect in the chapters, is actually atest as per the norm of the research requirement.

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CHAPTER 3

RESEARCH METHODOLOGY

3.1 Introduction.

This chapter describes the methodology and the procedures that will be applied to achieve the objectives of this research. This chapter sections include Research Design, Study Population and Sampling Procedures, Data Collection Method, Operationalization and Measurement, Data Analysis Techniques and Summary. This research is estimated to take four to six weeks in order to complete in terms of collecting data.

3.0 Research Design.

The beginning of the research started with the observation of the background and current issues happening all around the world in recent times. Then some of the topics were considered and brief analysis on each topic is conducted. Then current topic was chosen for further perusal. Then the significance problems associated with the selected topic was identified and specific filed of analysis was decide on. Specific research problem was built on based on the collected data.

Next, main goal to be achieved through the studies is defined. Questions that would answer the inquisitive was developed. Questions were specified in conjunction to the study's purpose. The literature review of the research was built on existing theories related to challenges faced by construction industry during the pandemic. Then the existing case studies and research papers were analyzed and studied carefully.

The Conceptual Framework was build based on the questions that were needed answers. Later on, the hypotheses were proposed and study built around it. Timeline of the study is fixed upon determining the study population and responses received

in earlier stage.

Hypothesis will be proven from collected data and intricate analysis by comparing if tabulated data is proven or not. Finally, the collected data be iterated to conclude the study if the barriers hindering the LCP have affected the safety improvement by G7 contractor in Selangor and Kuala Lumpur.

Figure 3.1: Research Design

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3.1 Study Population and Sampling Procedures

This research study focuses on G7 Category of Construction companies particularly in Selangor and Kuala Lumpur. From information derived from the Construction Industry Development Board (CIDB) Centralized Information Management System (CIMS), figure below is the summary of all contractors and their trade of registration focusing only in both regions.

State	Numbers of G7 Contractors	Rank
Johor	432	
Kedah	163	
Kelantan	98	
Melaka	126	
Negeri Sembilan	106	
Pahang	126	
Perlis	23	
Perak	172	
Pulau Pinang	378	
Sabah	385	
Sarawak	469	
Selangor	**1450**	**The second (2)**
Terengganu	189	
Wilayah Persekutuan	**1563**	**The first (1)**
Total	5680	

Figure 3.2: CIDB G7 Grades of Contractors by State

This study will focus on the state with two (2) greatest numbers of contractors with a G7 grade registered under CIDB. The reason this group of contractors was chosen as Selangor and Kuala Lumpur known as flourish state with megaproject which are built by contractors registered under this trade. Therefore, both states contribute to the development of other related business chain such as suppliers, subcontractors, machineries and service provider. They are also chosen as they are assumed to have larger amounts of yearly profits with yearly audited reports and numerous amounts of foreign workers parked under their companies. It is also well understood, that safety measures in controlling incident occurrence is the most crucial aspect need to be taken care of when dealing with the government regulations, and incident occurrence in the supply chain would have definitely impact the companies negatively. It is planned to gain respondents from several group of departments from the project department, the contract department, the account and finance department, the purchasing/procurement department and the safety and health department. The participants are anticipated to be from both genders, from age group 21 years old to 60 years old and from designation of supervisory or executive onwards to the top management.

The purpose of choosing employees from higher designation is because, the main objective to study organization improvement would be much more suitable for individuals in this stage of the hierarchy so that a precise and honest answer would be obtained. The questions are developed based on researcher's own experience working in a construction company. The interview questions will be both close and open ended as it would be addressing the issue on hand with more accuracy and detailing and the data obtained would be easier graphing/tabulation for interpretation of the results. The questionnaires would be distributed to the participants through email and WhatsApp via a link from google forms. The participants' names or their company particulars will not be collected during the questionnaire or interview to protect the anonymity status.

The survey will be formulated in a sequence way so that the participants could follow the flow in answering the questions such as starting from general demographic details, general opinions, safety and health, operation constraints, followed by financial constraints and finally conclusion-based opinion. The researcher is responsible to design the questions so that the respondents will have a clear view of the main objective and answer with much commitment of the real situation.

The secondary data such as news articles, previous research/studies and via books will not be used as those are already done during the conceptual stage and discussed in the background of the study; unless otherwise the result of the study is contradicting towards those research materials. The end of the study is aimed to give better objective or suggestions for future studies.

3.2 Data Collection Method.

The data for the research would be collected in semi-structured method. The data collected through the questionnaire would be tabulated for easier interpretation such as graphs, bar chat or pie charts. The data will be categorized accordingly based on given answers and participants race, gender, age, positions and severity or impacts of the issue. The best representation that portrays the result or conclusion of the study would be chosen and written in detail.

3.3 Operationalization and Measurement.

Conceptual Framework that has been developed is clearly showing the variables related to this case study. Each variable will influence the outcome of this study in different ways. With the clear development of the framework and listed hypotheses, the study would be steering in clear direction without much interruption and would focus mainly on debated issue. This would also avoid any unnecessary time and

resource wastages.

3.3.1 Independent Variables.

The independent variable is the variable that the researcher seeksto control or modifies and is believed to have a significant impact on the dependent variable. In this study, the author is searching for apotential effect on the dependent variable that may be triggered bya change in the independent variable. In this study we are lookingat 5 (five) types of the independent variable.

i. Lack of Management and Stakeholder Commitment impacts the adoption of LCP to improve safety of construction industries in Selangor and Kuala Lumpur.
ii. Financial constraints impact the adoption of LCP to improve safety of construction industries in Selangor and Kuala Lumpur.
iii. Lack of knowledge and skill impacts the adoption of LCP to improve safety of construction industries in Selangor and Kuala Lumpur.
iv. Lack of Government support impacts the adoption of LCP to improve safety of construction industries in Selangor and Kuala Lumpur.
v. Bad human attitudinal impacts the adoption of LCP to improve safety of construction industries in Selangor and Kuala Lumpur.

3.3.2 Mediating Variable.

The mediating variable of this study is adoption of LCP.

3.3.3 Dependent Variable.

Dependent variable is the variable that depends on the other variables that are being evaluated. These variables are supposed to shift as a result of experimental manipulation of independent variables or variables. This study has 1 (one) dependent variable which is safety improvement of construction sites.

These dependent variables would determine how the questionnaires and surveys arestructured in this study in order to receive answers that clarify the research questions. The basic of this study would be determined based on these dependent variables as it would give the clear picture on the problems.

3.4 Data Analysis Techniques.

This study is the process of studying the barriers faced by construction industry of category G7 in Selangor and Kuala Lumpur in adopting LCP to improve safety. The findings of the study will be used to classify relevant research problems.

3.4.1 Descriptive Analysis Techniques.

At the end of the research the collected data would be categorized according to thedemographic status of respondents. After that the data would be again tabulated asper the answers to find out the probability of higher response on each question as per category. Later the tabulated data would be interpreted in another appropriate datapresentation such as graphs, bar/pie charts or relevant tables.

For an example, a crosstab or two-way tabulation shows the proportions of the factors with distinct values for each of two variables, or cell proportions would be built. Then the row proportions would be examined, or the fractions in each group would be analyzed for ratios population.

With the descriptive analysis, we might be able to derive to conclusion that are related to the hypotheses. The presentation of the data shall give a clear picture on the problem that being studied.

3.4.2 Inferential Analysis Techniques.

Inferential methods can produce similar summary values to descriptive statistics. Asper required by the research fulfillment, the hypotheses are developed for the study purposes.

i. **Hypothesis tests.**

The hypothesis tests use sample of data answers questions as follows: -

- Does your organization implement Prevention through Design (PtD) at your construction sites before commencing work?
- Does financial constraint affect adoption of LCP?

Hypothesis test also would allow us to draw conclusions about certain theories or speculations.

ii. **Regression analysis.**

The regression analysis explains the relationship between the set of independent variables and the dependent variables. This research integrates the hypothesis teststhat help to assess if the relationships

found in the sample data currently occur in thepopulation. If the effect is statistically important, we will have sufficient evidence to conclude that the association occurs in the population rather than in this study.

iii. **Inferential Statistics.**

The point estimate for mean, standard deviation, and proportion of random sampleresponses could be determined using the Inferential Statistics results. It is, however,astoundingly doubtful that any of these point estimates are reliable. Since we cannotquantify all subjects in this population, there might be a margin of error in these figures.

iv. **Factor analysis.**

Factor analysis is a method used to minimize the number of variables to fewer factors. This technique removes the full common variance from all variables and places themin a common ranking. As an index of all variables, this score can be used for furtheranalysis.

v. **Cohort analysis.**

Cohort Analysis is a form of behavioral analytics in which users are grouped basedon their common characteristics to better track and understand their behaviors. Forexample, the questions could be based on the position of the employee and the responses could be evaluated on the basis of the category.

3.4.3 Questionnaire Design.

The research questionnaire in this study serves as a primary

instrument of data collection. The questions were developed with same definitions to target all respondents so that the data received is analyzed constantly; respondents chosen are from the managerial to the top management levels employees, and the questions designed are suitable for them as they oversee general business operation as a whole. There are a total of 54 (fifty-four) questions which are broken into 9 (nine)sections as follows:

Section A and B: This are general introductory of the researcher and the statementof the objective of the study.

Section 1: This section also named as Section A gathered 10 (ten) basic demographic data of respondents which consist of gender, age, ethnicity, highest level of education, field of study, areaof workplace, position at work place, monthly income, department at work place and years of experience in the construction industry. All these questions are made compulsory to answer.

Section 2: This section gathered 7 (seven) general close-ended questions which focuses on awareness of LCP. All these questions are made compulsory to answer.

Section 3: This section comprises of 5 (five) close ended questions related to barriers of management and stakeholder in adopting LCP to improve safety.

Section 4: This section comprises of 5 (five) close ended questions related to barriers of financial constraint in adopting LCP to improve safety.

Section 5: This section comprises of 8 (eight) close ended questions related to barriers of lack of knowledge and skill in adopting LCP to improve safety.

Section 6: This section comprises of 5 (five) close ended questions

related to barriers of lack of government support in adopting LCP to improve safety.

Section 7: This section comprises of 5 (five) close ended questions related to barriers of human attitudinal support in adopting LCP to improve safety.

There are total of 28(twenty-eight) questions of independent variables are made compulsory to answer.

Section 8: This section comprises of 8 (eight) close ended questions related to safety of construction site. All of 8 (eight) questions related to the impact of barrier in adopting to improve safety Improvement as the Dependent Variable of this study. All these questions are made compulsory to answer.

Section 9: This is the final opinion and conclusion section with gathers 2 (two) open ended question which is related to strategies and recommendation on how the Government could assist in promoting LCP to improve safety of G7 contractors in Selangor and Kuala Lumpur.

There are 3 (three) types of close-ended questions in this questionnaire which is:

i. Basic yes or no question;
ii. Likert scale where respondents would have to rate their feelings based on;

    1: strongly disagree, 2: disagree, 3: neutral, 4: agree, 5 strongly agree; and

iii. Close ended with sets of multiple-choice answers that respondents are allowed to choose from. Respondent are allowed to choose more than 1 (one) answer for a question. This kind of questions are the analyzed individually via the SPSS.

3.5 Pilot Test.

In order to ensure the reliability of research and its response; a pilot test was done via a SPSS tool known as the Cronbach's alpha. Using this method, all internal consistency is tested using all variables of the Likert scale questions. As long as the reliability test suffice with a minimum rate of 0.7 above; the test is assumed to have achieved reliability and is therefore the study is acceptable to be proceeded accordingly.

According to previous researchers, a number of 30 to 50 responses is a realistic, optimal, and acceptable for a sample test. According to Connelly (2008) and Treece & Treece (2005), the number of samples for the study should be 10% of the total number of respondents. In this research, the total number of respondents was 139; 10% out of the total would be used for the pilot test was supposedly 14 samples. The researcher then distributed the questionnaires to a total of 20% equivalent to 28 individuals working in the G7 construction company.

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.983	.983	28

3.7.1: Table Cronbach Reliability

Table 3.7.1 shows the Cronbach Alpha's reliability result of this study. Table above was done with inputs of 28 (twenty-eight) close-ended Likert Scalequestions and results were acceptable at a rate of 98.3 % percent.

Item-Total Statistics					
	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
BARR1:MGMTANDSH1	127.58	170.038	.791	.	.983
BARR1:MGMTANDSH2	127.57	170.172	.802	.	.982
BARR1:MGMTANDSH3	127.58	167.253	.870	.	.982
BARR1:MGMTANDSH4	127.54	168.888	.850	.	.982
BARR1:MGMTANDSH5	127.49	170.104	.813	.	.982
BARR2:FINANCIAL1	127.49	173.215	.752	.	.983
BARR2:FINANCIAL2	127.50	172.267	.773	.	.983
BARR2:FINANCIAL3	127.57	168.499	.830	.	.982
BARR2:FINANCIAL4	127.52	169.792	.853	.	.982
BARR2:FINANCIAL5	127.51	171.585	.797	.	.982
BARR3:LACKOFSKILL1	127.55	169.212	.808	.	.982
BARR3:LACKOFSKILL2	127.57	169.047	.879	.	.982
BARR3:LACKOFSKILL3	127.51	170.474	.872	.	.982
BARR3:LACKOFSKILL4	127.51	169.541	.879	.	.982
BARR3:LACKOFSKILL5	127.53	169.081	.859	.	.982
BARR3:LACKOFSKILL6	127.49	170.296	.879	.	.982
BARR3:LACKOFSKILL7	127.54	168.606	.886	.	.982
BARR3:LACKOFSKILL8	127.52	170.325	.877	.	.982
BARR4:LACKOFGOVSUPPORT1	127.55	169.064	.867	.	.982
BARR4:LACKOFGOVSUPPORT2	127.53	170.014	.853	.	.982
BARR4:LACKOFGOVSUPPORT3	127.51	172.059	.758	.	.983
BARR4:LACKOFGOVSUPPORT4	127.49	171.911	.789	.	.983
BARR4:LACKOFGOVSUPPORT5	127.54	169.361	.817	.	.982
BARR5:HUMANATTITUDE1	127.54	171.258	.747	.	.983
BARR5:HUMANATTITUDE2	127.46	174.725	.656	.	.983
BARR5:HUMANATTITUDE3	127.53	171.392	.796	.	.982
BARR5:HUMANATTITUDE4	127.54	170.991	.796	.	.982
BARR5:HUMANATTITUDE5	127.48	174.637	.651	.	.983

Table 3.7.2. Cronbach Alpha's reliability result

Based on table 3.7.2 above that is focusing on Cronbach Alpha value is 98.3% is consider good and reliable.

3.6 Data Collection.

A total of 200 google form questionnaires were distributed to respondents via emails and WhatsApp for a period of 3 (three) weeks and a total of 139 responses were received which accounted to 69.5% of success response rate.

3.7 Summary of Chapter 3.

Overall, in Chapter 3 (three), the research design was discussed in details on how the research was built from the beginning. Each stage of the how the research topics was decided together with the intended data collection method and sampling population was described. Then the variables involved in this study were identified and categorized appropriately for better understanding and clear picture on the direction of the study. Lastly once the research is carried out, how the data will be presented, discussed and what type of methods will be used was explained orderly. Also, how the conclusions or recommendations would be derived at the end of the study were also been cleared up in this section.

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CHAPTER 4

RESULTS AND DISCUSSION.

4.1 Introduction.

The findings that were gathered via the questionnaire distributed were analyzed using Statistical Package for the Social Sciences (SPSS) and used to generate solutions and conclusions for the issues raised in the previous chapters. To interpret the outcomes or findings, the precise numerical data was used to create relevant diagrams such as bar charts, and data tables. To determine the validity and reliability of the questionnaires as a whole, they were placed through a reliability test. The data values were calculated by using the mean and standard deviation from the data collected.

Questionnaire Dimensions		No of Items	Relationship
Section 1:	Demographic Profile	10	
Section 2:	General Awareness and Barrier in LPC	6	
Section 3:	Barrier of Management Questions	5	Independent Variable
Section 4:	Barrier of Financial Questions	5	Independent Variable
Section 5:	Barrier of Knowledge Questions	8	Independent Variable
Section 6:	Barrier of Government Support Questions	5	Independent Variable
Section 7:	Barrier of Human Attitude Questions	5	Independent Variable
Section 8:	Safety Improvement Questions	8	Dependent Variable
Section 9:	Opinion and Conclusion	2	Research suggestion
Total Items		**54**	

Table 4.1.1: Summary of Questionnaire Dimensions

4.2 Section 1: Demographic Analysis.

The values of a variable are displayed in the frequency and descriptive tables as below, weighted by the number of occurrences of each single value. Additionally, percentages are shown.

Variable	1	2	3	4	5	6	7
N	Gender	Race	Qualification	Field of Study	Work Area	Position	Dept
Valid	139	139	139	139	139	139	139
Missing	0	0	0	0	0	0	0

Table 4.2.1. Summary of Frequency Statistic

Variables	N	Missing
Age group	139	0
Experience	139	0
Income	139	0

Table 4.2.2. Summary of Descriptive Statistic

The table 4.2.1 and 4.2.2. for frequency and descriptive statistic, respectively shows the output of the Statistics for demographic sections. There were no missing values found, the number of valid cases is the full 139 respondents for the 10 (ten) variables in this section.

A1Gender		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Female	50	36.0	36.0	36.0
	Male	89	64.0	64.0	100.0
	Total	139	100.0	100.0	

A3. Race		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Malay	62	44.6	44.6	44.6
	Chinese	39	28.1	28.1	72.7
	India	33	23.7	23.7	96.4
	Other	5	3.6	3.6	100.0
	Total	139	100.0	100.0	

A4. Qualification		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Secondary/Diploma	16	11.5	11.5	11.5
	Bachelor's Degree	99	71.2	71.2	82.7
	Master's Degree/Ph.D	20	14.4	14.4	97.1
	Other Professional Qualification	1	0.7	.7	97.8
	Other	3	2.2	2.2	100.0
	Total	139	100.0	100.0	

A5.Field of Study		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Accounting and Finance	12	8.6	8.6	8.6
	Business Management/Administration	31	22.3	22.3	30.9
	Contract/Quantity Survey	11	7.9	7.9	38.8
	Engineering Safety and Health	36	25.9	25.9	64.7
	Other-Civil Eng	49	35.3	35.3	100.0
	Total	139	100.0	100.0	

6.Work Area		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Kuala Lumpur	66	47.5	47.5	47.5
	Selangor	70	50.4	50.4	97.8
	Other	3	2.2	2.2	100.0
	Total	139	100.0	100.0	

A7.Position		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Top Management	10	7.2	7.2	7.2
	Managerial (Office)	21	15.1	15.1	22.3
	Project Manager (Construction Site)	25	18.0	18.0	40.3
	Health & Safety	25	18.0	18.0	58.3
	Executive/Engineer	41	29.5	29.5	87.8
	Supervisor	11	7.9	7.9	95.7
	Other	6	4.3	4.3	100.0
	Total	139	100.0	100.0	

A8.Department		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Management	15	10.8	10.8	10.8
	Project	67	48.2	48.2	59.0
	Account and Finance	10	7.2	7.2	66.2
	Contract	11	7.9	7.9	74.1
	Purchasing/procurement	6	4.3	4.3	78.4

	Safety and Health	28	20.1	20.1	98.6
	Other	2	1.4	1.4	100.0
	Total	139	100.0	100.0	

Table 4.2.3: Summary for Demographic Frequency Data Collections.

The sample of respondents' gender consisted of 139 (36.0%) female and (64%) male, from = 200 respondents. The sample of respondents' race consisted of 139 the highest (44.6%) Malay, followed by (28.1%) Chinese, the third (23.7%) India and (3.6%) other races from Sabah and Sarawak.

The sample of respondents' qualification of 139, the highest (35.3%) other qualification-Civil engineering, followed by (25.9%) Eng. Safety and Health, the third (22.3%) Business Management and (8.6%) accounting and finance.

The sample of respondents' work area of 139, the highest (50.4%) from Selangor, followed by (47.5%) from Kuala Lumpur and (2.2%) from other state. The sample of respondents' position of 139, the highest (29.5%) executive/engineer, followed by (18.0 %) from both position of project manager and safety & health personnel, the third highest (15.1%) from managerial office, and the lowest (7.2%) the top management level. The sample of respondents' department of 139, the highest (48.2%) project team, followed by (20.1%) safety & health, the third (10.8%) management team.

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A9.Experience	Frequency	Percent	Valid Percent	Cumulative Percent
Below 5 years	25	18.0	18.0	18.0
Between 6 to 10 years	29	20.9	20.9	38.8
Between 11 to 20 years	54	38.8	38.8	77.7
20 years and above	31	22.3	22.3	100.0
Total	139	100.0	100.0	

A10.Income	Frequency	Percent	Valid Percent	Cumulative Percent
Below RM5000	44	31.7	31.7	31.7
Between RM5001-RM10000	52	37.4	37.4	69.1
Between RM10001-RM20000	35	25.2	25.2	94.2
RM20000 above	8	5.8	5.8	100.0
Total	139	100.0	100.0	

A2.Age group	Frequency	Percent	Valid Percent	Cumulative Percent
31-40	41	29.5	29.5	45.3
41-50	62	44.6	44.6	89.9
51-60	13	9.4	9.4	99.3
Above 60	1	0.7	0.7	100.0
Total	139	100.0	100.0	

Table 4.2.4: Summary for Demographic Descriptive Data Collections.

The sample of respondents' department of 139, (82%) experience more than 5 years and (18%) have experience less than 5 years. The sample of respondents' department of 139, (94.2%) salary below RM20,000 and (5.8%) salary more than RM20,000The sample of respondents' department of 139, (89.9%) age between 21-50 years old, (10.1%) age more than 50 years old.

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4.3 Section 2: Awareness of LCP Analysis

In Section 2, the questions in this section were closed ended 6 questions of answer option either Yes or No. The answers from this variable were separated and analyzed individually and summed upunder one main section response.

4.3.1. Descriptive Analysis

No	Stateme nt	Yes (%)	No (%)
B1	Does your organization implement PtD can improve safety at your construction sites before commencing work?	41.0	**59.0**
B2	Does your organization implement LPS can improve safety at your construction sites before and during commencing work?	**75.5**	24.5
B3	Does your organization implement Visualization System (Signages and warning system) can improve safety at your construction sites?	**97.1**	2.9
B4	Does your organization implement 5S(Housekeeping system) can improve safety at your construction sites?	**100**	0
B5	Does your organization aware that LCP can improve overall safety at your construction sites?	**93.5**	6.5
B6	Are there barriers in adopting LCP to improve safety at construction sites?	**97.1**	2.9

Table 4.3.1: LCP Awareness Question Data Summary

Awareness		Frequency	Percent	Valid Percent	Cumulative Percent
B1	Yes	57	41.0	41.0	41.0
	No	82	59.0	59.0	100.0
B2	Yes	105	75.5	75.5	75.5
	No	34	24.5	24.5	100.0
B3	Yes	135	97.1	97.1	97.1
	No	4	2.9	2.9	100.0
B4	Yes	139	100.0	100.0	100.0
	No	0	0	0	0
B5	Yes	130	93.5	93.5	93.5
	No	9	6.5	6.5	100.0
B6	Yes	135	97.1	97.1	97.1
	No	4	2.9	2.9	100.0

Table 4.3.2: LCP Awareness Question Data Summary

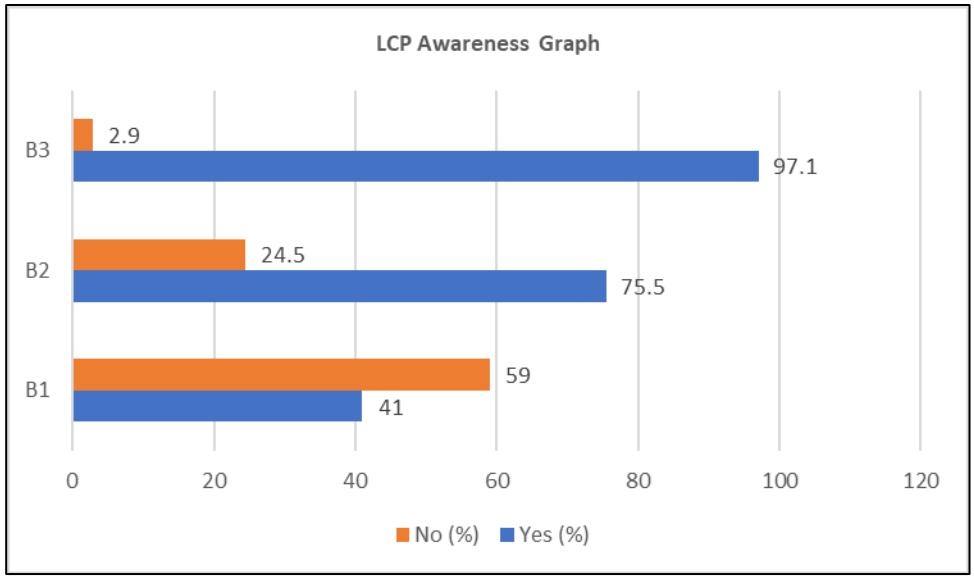

Figure 4.3.1: LCP Awareness Graph

Both table 4.3.1., Table 4.3.2 and Figure 4.3.1. summarized the awareness level of LCP to improve safety of organization and it shows the response garnered from all LCP awareness questions in percentages (%). The figures shows that most of the respondents optimistic and aware that LCP can improve safety in their organization. In order to improve safety of construction site through LCP, 41.0 % of respondents implement prevention through Design (PtD), 75.5 % of respondents implemented Last Planner System (LPS), 97.1 % of respondents implemented visualization through signage and warning system, and 100 % of respondent optimistic they implemented housekeeping system. 93.5 % respondents aware that can improve safety of their construction site, however there are barriers that preventing them from adopting as a result from 97.1 % of respondents.

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
SUM_AWARENESS	.237	139	<.001	.805	139	<.001

a. Lilliefors Significance Correction

Table 4.3.3: Awareness Question Test of Normality

The normality test as can be seen from table 4.3.3 above shows the significant level of this variable is at a correlation of < 0.01 level.

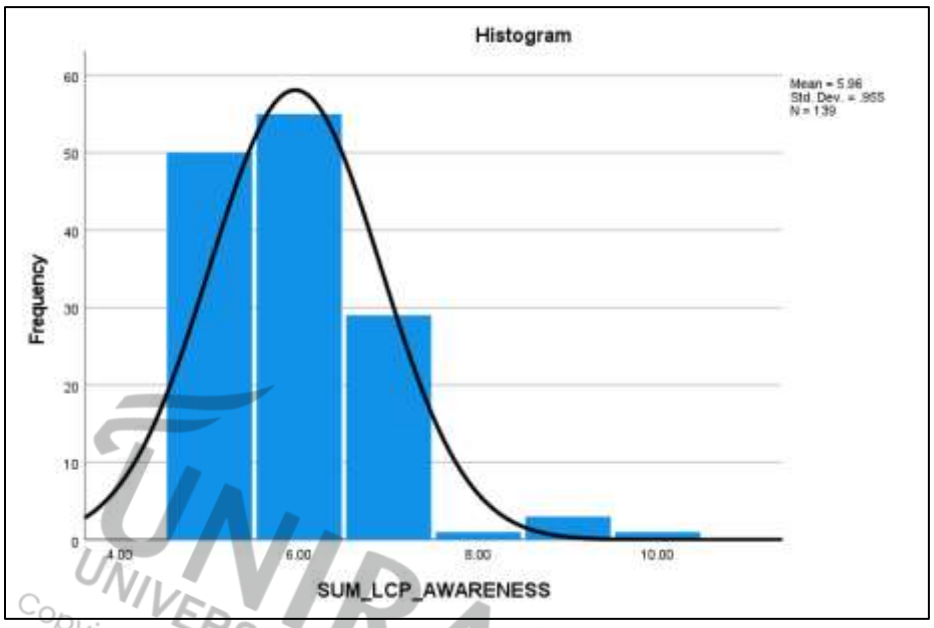

Figure 4.3.2: Distribution of Summation of LCP Awareness Questions

Figure 4.3.2 shows the result of the distribution of the general questions with mean score of all the variable under this section is 5.96 while the median is 6, indicating that its left skewed (negatively skewed).

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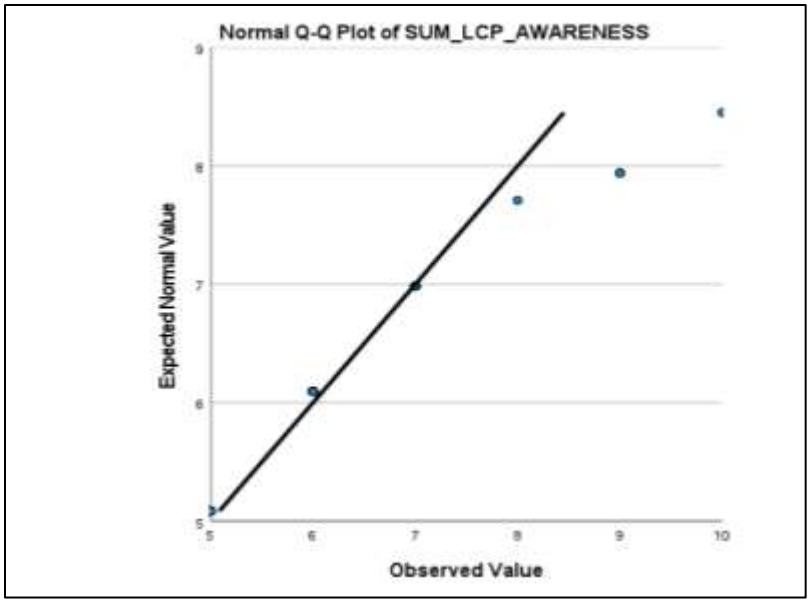

Figure 4.3.3: Distribution of Q-Q Plot for Summation of Awareness Questions

4.4 Section 3: Barrier in Adopting LCP to Improve Safety

Barrier 1: Lack in Management and Stakeholder Support

The questions in this section were closed ended with Code in BARR1: MGMTANDSH. The questions of C1 1 to C5 used the Likert scale where respondents would have to rate based on;

1: strongly disagree, 2: disagree, 3: neutral, 4: agree, 5 strongly agree.

Descriptive Analysis for barrier of Management and Stakeholder Commitment summarized as below:

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No	Statement	1	2	3	4	5
C1	Lack of commitment from management and stakeholders has affected adoption of LCP?	0	2.2	1.4	23.7	72.7
C2	Management and stakeholder provision of assessment such as Pre task hazard analysis or Hazard Identification Risk Analysis and Risk Control in construction site has affected adoption of LCP?	0	1.4	2.9	23.0	72.7
C3	Management and stakeholder provision of Standard Operating Procedure in the Method Statement before work commencing has affected adoption of LCP?	0.7	1.4	3.6	19.4	74.1
C4	Management and stakeholder provision of time to innovate ideas and support their efforts has affected adoption of LCP.	0.7	0.7	2.9	17.3	78.4
C5	Transparency and efficiency in communication and planning by the management and stakeholder has affected adoption of LCP.	0	0.7	5.0	12.9	81.3

Table 4.4.1: Barrier of Management and Stakeholder Commitment Data

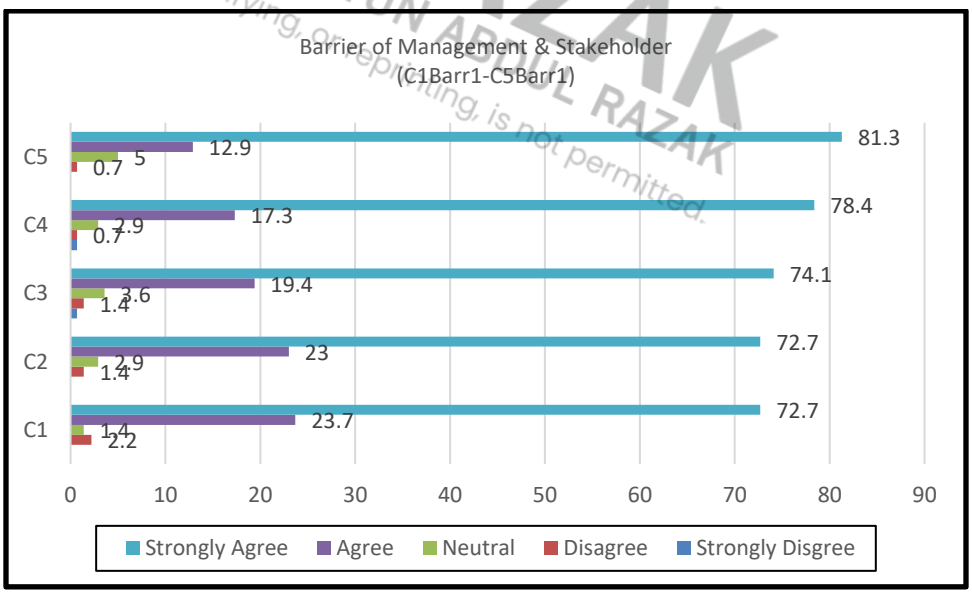

Figure 4.4.1.: Barrier of Management and Stakeholder Commitment Question Graph

Both 4.4.1 and 4.4.2 above shows the response garnered from all barriers from management and stakeholder related to questions in Likert scale. On a positive note, for C1 statement, 72.7% of respondents has voted in general that lack of commitment from management and stakeholders has affected adoption of LCP and 23.7 % agree, but 1.4 % neutral and 2.3 % disagree with the statement. The 2 lowest percentage resulted may be due to the lack of experience of respondents in construction site safety workflow.

For C2 statement, 72.7 % totally agree that Hazard Identification Risk Analysis and Risk Control in construction site has affected adoption of LCP, followed by 23.0 % agree, but 2.9 % neutral, and 1.4 % disagree. For C3 Statement, 74.1 % totally agree that management and stakeholder provision of Standard Operating Procedure in the Method Statement before work commencing has affected adoption of LCP, followed by 19.4 % agree, but 3.6 % neutral, 1.4 % disagree and 0.7 totally disagree.

For C4 Statement, 78.4 % totally agree that management and stakeholder provision of time to innovate ideas and support their efforts has affected adoption of LCP, followed by 17.3 % agree, but 2.9 % neutral, 0.7 % disagree and 0.7 totally disagree.

For questions C5 relating to Transparency and efficiency in communication and planning by the management and stakeholder has affected adoption of LCP, 81.3 % totally agree, followed by 12.9 % disagree, but 5.0 % neutral and 0.7 % disagree. The 2 lowest percentage resulted from neutral and disagree respondents respectively, may be due to the lack of experience in construction site safety workflow.

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Statistics

SUM_BARR_MGMT

N	Valid	138
	Missing	1
Mean		23.4493
Median		25.0000
Std. Deviation		2.87723
Skewness		-2.658
Std. Error of Skewness		.206
Kurtosis		8.150
Std. Error of Kurtosis		.410
Minimum		9.00
Maximum		25.00

Table 4.4.2. Summation of Barrier in Management and Stakeholder Support

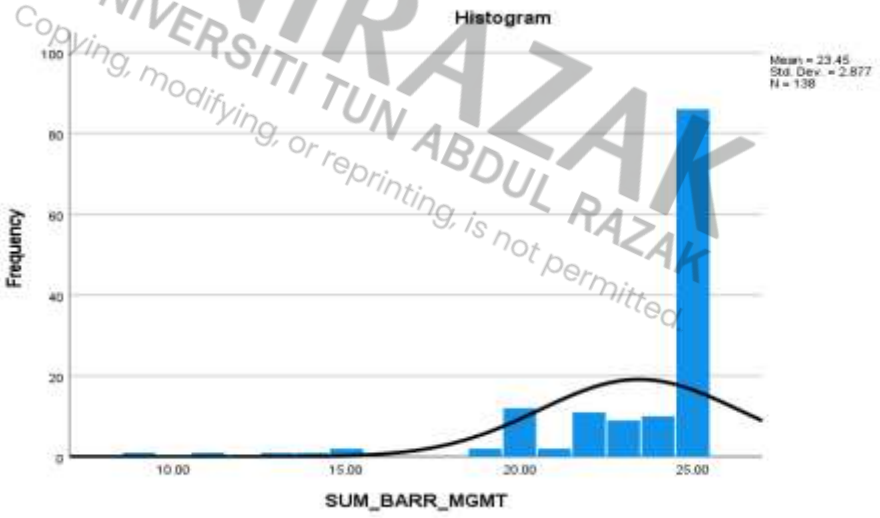

Figure 4.4.2: Distribution of Summation of Management and Stakeholder Support

Table 4.4.2 and Figure 4.4.2 showed the result of the distribution of the barrier by management and stakeholder commitment in adopting LCP to improve safety questions with mean score of all the variable under this section is 23.45 while the

median is 25, indicating that its right skewed (positively skewed) with skewness value of -2.658 and kurtosis value is 8.15

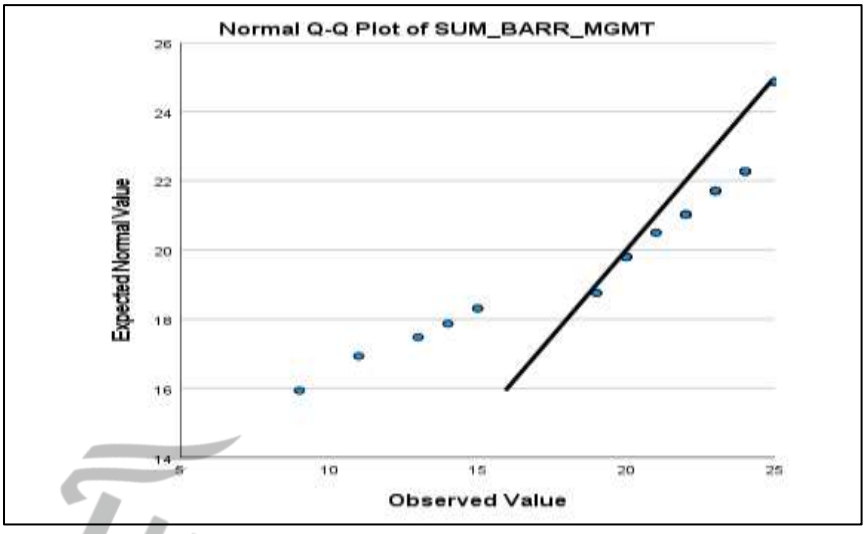

Figure 4.4.3: Distribution of Q-Q Plot for Summation of Barrier of Management and Stakeholder Commitment

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4.5 Section 4 : Barrier of Financial Constraint

The questions in this section were closed ended which are BARR2:FIN1 to BARR2:FIN2 used the Likert scale where respondents would have torate based on;

1: strongly disagree, 2: disagree, 3: neutral, 4: agree, 5 strongly agree.

The answers from BARR2:FIN variable were separated and analyzed individually and summed up under one main section response.

No	Statement	1	2	3	4	5
D1	Financial constraint has affected adoption of LCP	0	0	2.9	19.4	77.7
D2	Low tender price and insufficient budget has affected adoption of LCP.	0	0	4.3	16.5	79.1
D3	Expensive training cost and hiring consultant in construction site has affected adoption of LCP	0	22	4.3	17.3	76.3
D4	Improvement of incentive for motivation in construction site has affected adoption of LCP.	0	7	5.8	14.4	79.1
D5	High turnover rate due to low wages of workers has affected adoption of LCP	0	0	5	16.5	78.4

Table 4.5.1: Financial Constraint Data

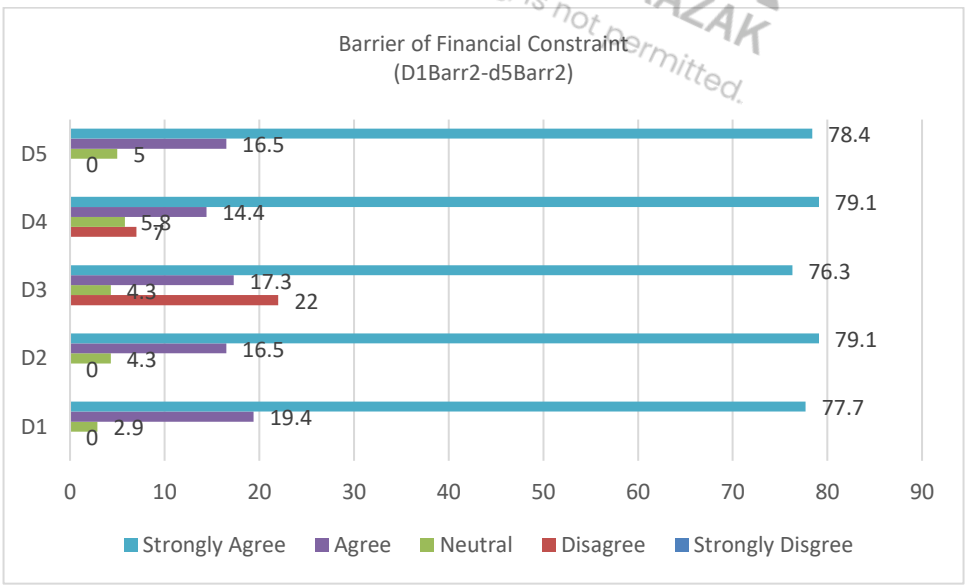

Figure 4.5.1: Financial Constraint Bar-Chart

Both table 4.5.1 and figure 4.5.1 above shows the response garnered from all financial constraint barrier related questions in Likert scale in BARR2FINANCIAL1 to BARR2FINANCE5. For D1 statement, the highest frequency of response was respondents strongly agreeing in general that financial constraint has affected adoption of LCP with a rate of 77.7 % strongly agreeing, 19.4 % agreeing but 2.9 % neutral towards this statement. Unsurprisingly, none of them answered strongly disagree or disagree towards this statement.

For D2 statement, 79.1 % strongly agree and followed by 16.5 % agree but 4.3 % neutral towards the statement that low tender price and insufficient budget has affected adoption of LCP and unsurprisingly none of them totally disagree or disagree with the statement. For D3 statement, 76.3 % strongly agree and followed by 17.3 % agree but 4.3 % neutral and 2.2 % disagree towards the statement that an expensive training cost and hiring consultant in construction site has affected adoption of LCP and again unsurprisingly none of them totally disagree with the statement. For D4 statement, 79.1 % strongly agree and followed by 14.4 % agree but 5.8 % neutral and 7.0 % disagree towards the statement that improvement of incentive for motivation in construction site has affected adoption of LCP and again unsurprisingly none of them totally disagree with the statement.

Lastly, for D5 statement, 78.4 % strongly agree and followed by 16.5 % agree but 5.0 % neutral towards the statement that high turnover rate due to low wages of workers has affected adoption of LCP and again unsurprisingly none of them totally disagree or strongly disagree with the statement.

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Statistics		
SUM_BARR_FINANCE		
N	Valid	139
	Missing	0
Mean		23.6259
Median		25.0000
Std. Deviation		2.49136
Skewness		-1.966
Std. Error of Skewness		.206
Kurtosis		3.438
Std. Error of Kurtosis		.408
Minimum		15.00
Maximum		25.00

Table 4.5.2: Summation of Barrier in Financial Constraint Data

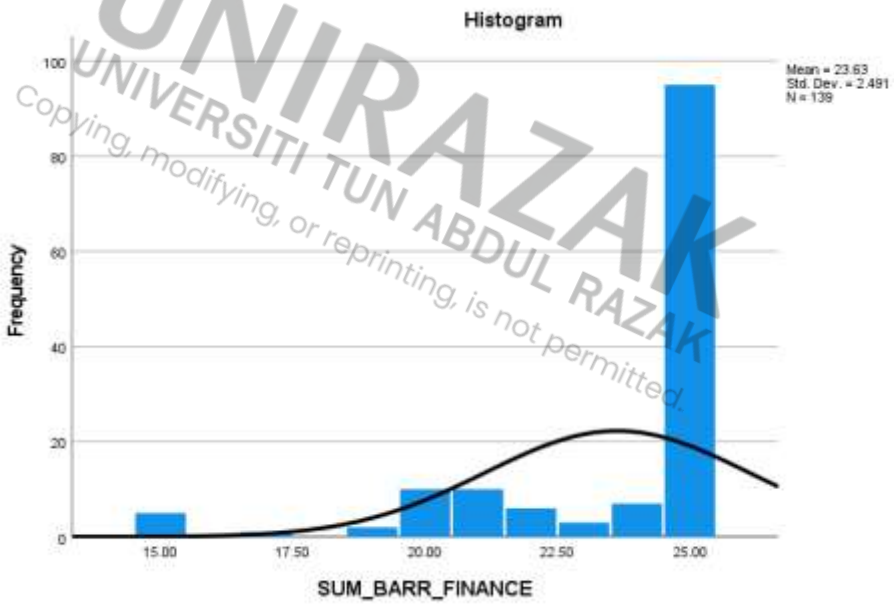

Figure 4.5.2: Distribution of Summation of Barrier of Financial Constraint

Figure 4.5.2 showed the result of the distribution of the barrier of financial constraint questions with mean score of all the variable under this section is 23.63 and the median is 25, indicating that its right skewed (positively skewed) with skewness value of -1.97 and kurtosis value is 3.44.

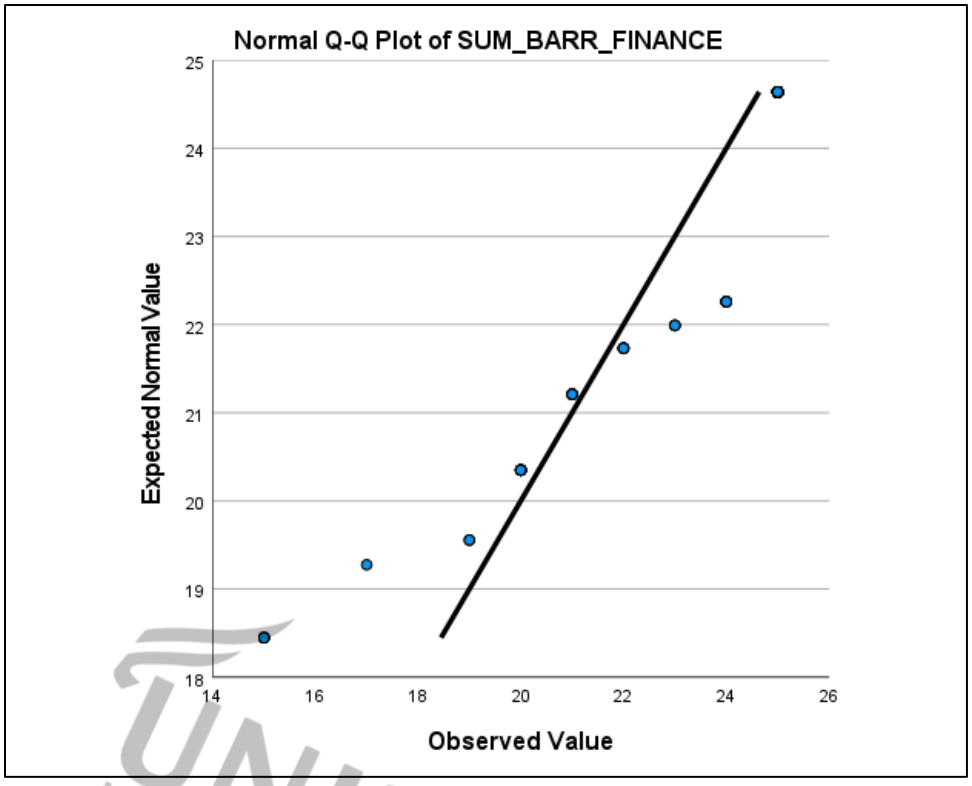

Figure 4.5.3: Distribution of Q-Q Plot for Summation Financial Constraint

4.6 Section 5 : Barrier of Lack in Knowledge and Skill

The questions in this section were all closed ended. The questions of BARR3SKILL1 to BARR3SKILL8 used the Likert scale where respondents would have to rate based on; *1: strongly disagree, 2: disagree, 3: neutral, 4: agree, 5 strongly agree*.

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No	Statement	1	2	3	4	5
E1	Lack of knowledge and technical skill has affected adoption of LCP.	0	2.2	3.6	16.5	**77.7**
E2	Misunderstanding about manufacturing Lean principles applied in construction has affected adoption of LCP	0	0.7	5	19.4	**74.8**
E3	Inadequate level of education and awareness has affected adoption of LCP	0	0	5.0	17.3	**77.7**
E4	Unavailability of local training center such as LCP Institute has affected adoption of LCP	0	0.7	5.8	13.7	**79.9**
E5	Skill of Prevention through Design (PtD) Techniques to prevent incident at design stage has affected adoption of LCP	0.7	0	4.3	16.5	**78.4**
E6	Skill of continuous improvement or KAIZEN Techniques to prevent incident has affected adoption of LCP	0	0.7	3.6	14.4	**79.9**
E7	Skill of Last Planner System (LPS) Techniques to prevent incident before commencing work has affected adoption of LCP	0	1.4	4.3	16.5	**77.7**
E8	Lack of professional on job guidance to provide the experiences has affected adoption of LCP	0	0	5	18	**77**

Table 4.6.1: Barrier Lack of Knowledge and Skill Data

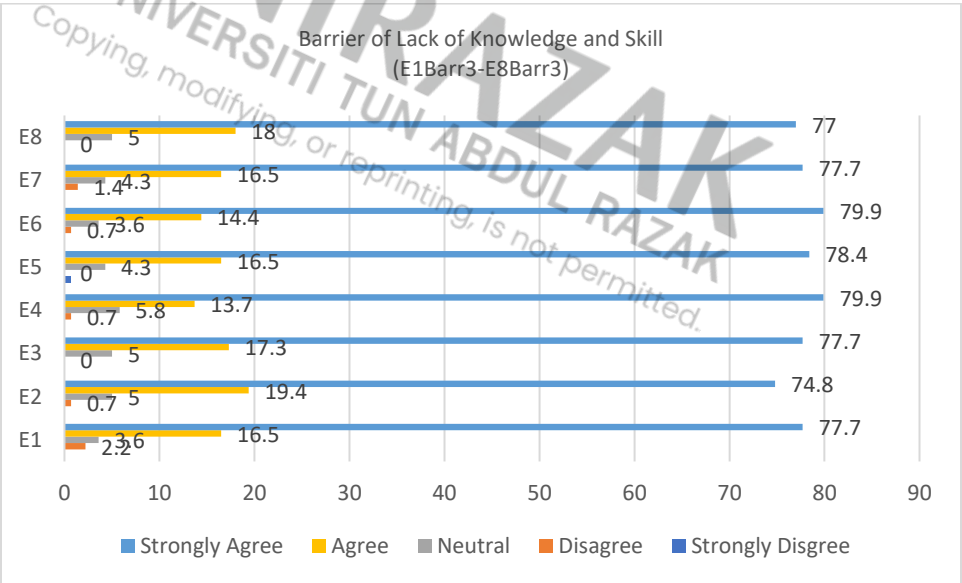

Figure 4.6.1: Barrier Lack of Knowledge and Skill Graph

Table 4.6.1 above shows the response garnered from all barrier of lack in knowledge and skill related-questions in Likert scale.

The highest frequency of response was respondents in general question of E1

strongly agreeing 77.7 % that lack of knowledge and technical skill has affected adoption of LCP. It is followed by 16.5 % agree but 3.6 % being neutral and 2.2 % disagree towards this statement.

For E2 statement, 74.8 % totally agree that misunderstanding about manufacturing Lean principles applied in construction has affected adoption of LCP, followed by E3 statement 77.7 % respondents strongly agreed that inadequate level of education and awareness has affected adoption of LCP, 77.7 % respondents also strongly agree towards the statement E4 that Unavailability of local training center such as LCP Institute has affected adoption of LCP.

For E5 statement, 78.4 % of respondents strongly agree that skill of Prevention through Design (PtD) Techniques to prevent incident at design stage has affected adoption of LCP. While for E6 statement, 79.9 % strongly agree that skill of continuous improvement or KAIZEN Techniques to prevent incident has affected adoption of LCP.

For E7 statement, 77.7 % strongly agree that Skill of Last Planner System (LPS) Techniques to prevent incident before commencing work has affected adoption of LCP, and lastly for statement E8, 77.0 % strongly agree that lack of professional on job guidance to provide the experiences has affected adoption of LCP.

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Statistics

SUM_BARR_SKILL

N	Valid	137
	Missing	2
Mean		37.7956
Median		40.0000
Std. Deviation		4.25845
Skewness		-2.204
Std. Error of Skewness		.207
Kurtosis		4.254
Std. Error of Kurtosis		.411
Minimum		22.00
Maximum		40.00

Table 4.6.2: Summation of Barrier in Lacking of Knowledge and Skill Data

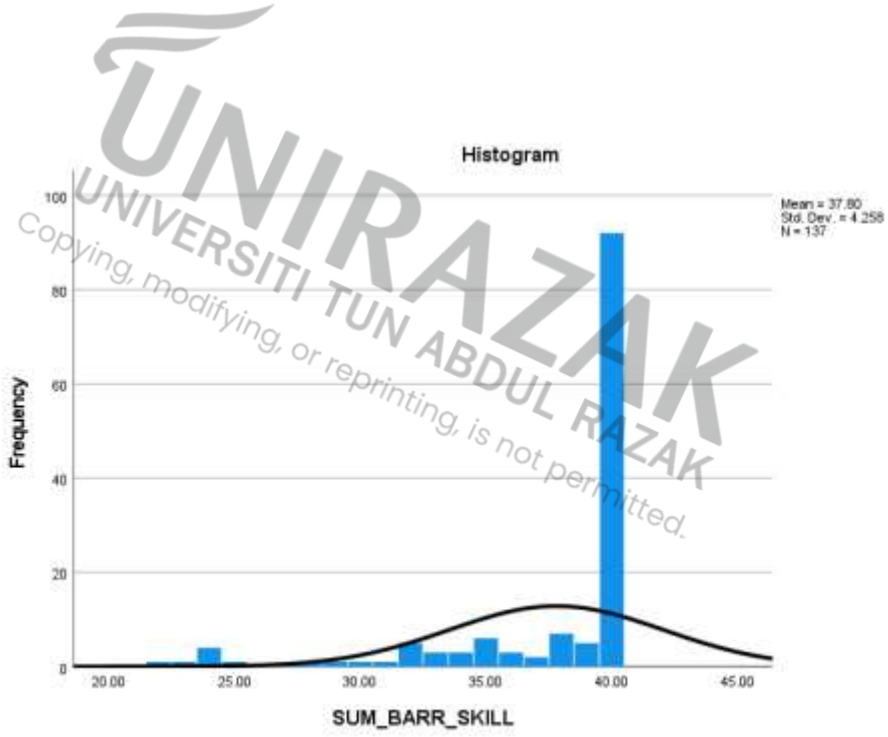

Figure 4.6.2: Distribution of Summation of Lacking in Knowledge and Skill

Figure 4.6.2 shows the result of the distribution of the barrier of lack in knowledge and skill questionswith mean score of all the variable under this section is 37.80 and the median is 40, indicating that its right skewed (positively skewed) with skewness value of -2.20 and kurtosis value is 4.254.

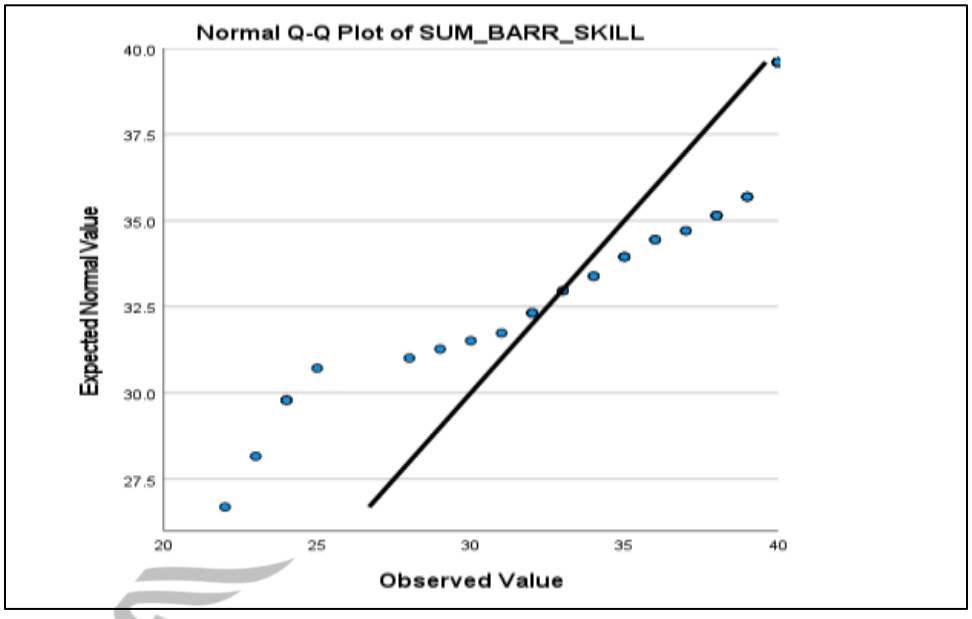

Figure 4.6.3: Distribution of Q-Q Plot for Summation Barrier of Lack in Knowledge and Skill

4.7 Section 6 : Barrier of Lack in Government Support

The questions in this section were all closed ended. The questions in this section were all closed ended. The questions of F1BARR4LACKOFGOVSUPPORT1 to F5BARR4LACKOFGOVSUPPORT5 used the Likert scale where respondents would have to rate based on;

1: strongly disagree, 2: disagree, 3: neutral, 4: agree, 5 strongly agree.

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No	Statement	1	2	3	4	5
F1	Lack of government support has affected adoption of LCP	0	1.4	4.3	18	76.3
F2	Inconsistent policy of government has affected adoption of LCP	0	0.7	5.0	16.5	77.7
F3	Economic and inflation has affected adoption of LCP	0	0	5.0	16.5	78.4
F4	Lack of government's promotion or incentive to the G7 company which practice has affected adoption of LCP	0	0	5.0	13.7	81.3
F5	LCP at your workplace is/was affected by unavailability of local training center which lack of collaboration with government agencies such as NIOSH, DoSH, JKR and CIDB	0	1.4	5.0	15.1	78.4

Table 4.7.1: Barrier of Lack in Government Support Data

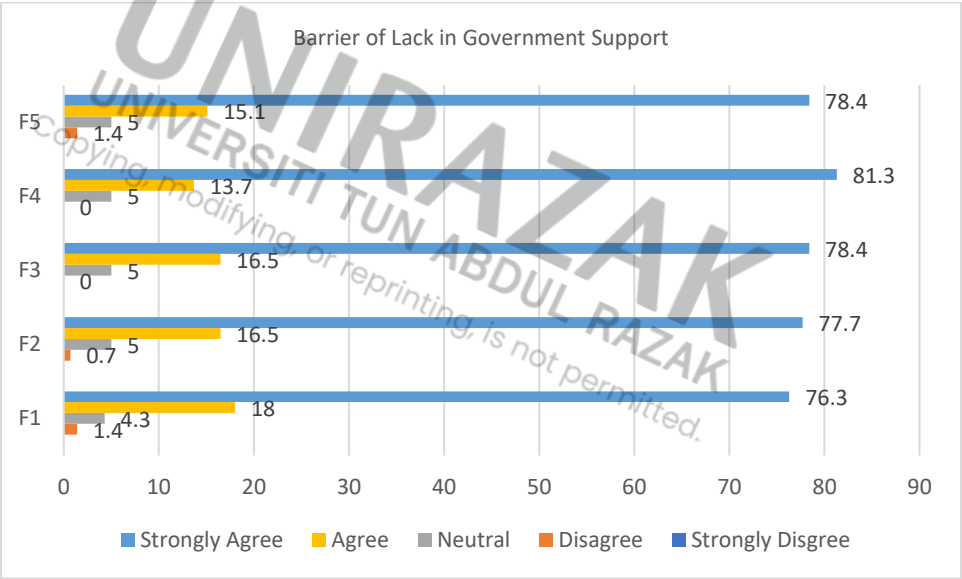

Figure 4.7.1: Barrier of Lack in Government Support Graph

Table 4.7.1 and Figure 4.7.1.1 above show the response garnered from all barrier of lack in knowledge and skill related-questions in Likert scale. The highest frequency of response was respondents in general question of F1 strongly agreeing 76.3 % that Lack of government support has affected adoption of LCP.

For F2 statement, 77.7 % strongly agree that Inconsistent policy of government has affected adoption of LCP, followed by F3 statement 78.4 % respondents strongly agreed that economic and inflation has affected adoption of LCP, 81.3 % respondents also strongly agree towards the statement F4 that Lack of government's promotion or incentive to the G7 company which practice has affected adoption of LCP.

Lastly for F5 statement, 78.4 % of respondents strongly agree that LCP at your workplace is/was affected by unavailability of local training center which lack of collaboration with government agencies such as NIOSH, DoSH, JKR and CIDB.

Statistics

SUM_BARR_GOVSUPP

N	Valid	139
	Missing	0
Mean		23.6043
Median		25.0000
Std. Deviation		2.61993
Skewness		-2.238
Std. Error of Skewness		.206
Kurtosis		4.734
Std. Error of Kurtosis		.408
Minimum		13.00
Maximum		25.00

Table 4.7.2: Summation of Barrier in Government Support Data

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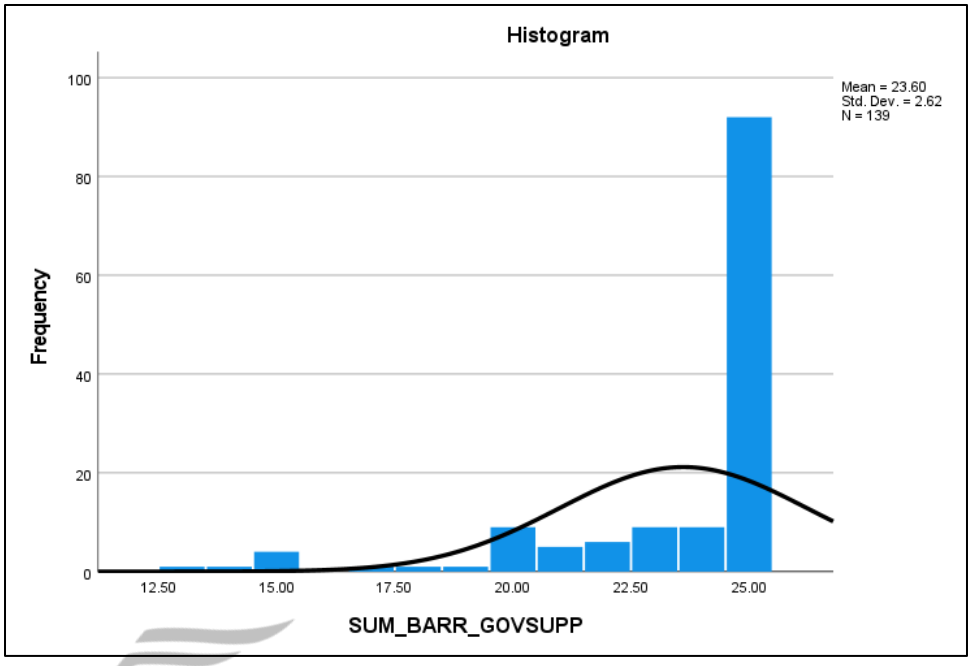

Figure 4.7.2: Distribution of Summation of Barrier of Lack in Government Support

Figure 4.7.2 showed the result of the distribution of the Barrier of Lack in Government Support questions with mean score of all the variable under this section is 37.80 and the median is 40, indicating that its right skewed (positively skewed) with skewness value of -2.24 and kurtosis value is 4.73..

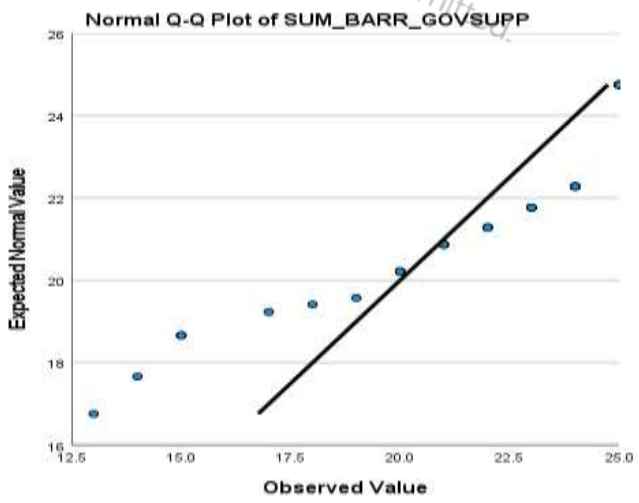

Figure 4.7.3: Distribution of Q-Q Plot for Barrier of Lack in Government Support

4.8 Section 7 : Barrier of Human Attitudinal

The questions in this section were all closed ended. The questions in this section were all closed ended. The questions of G1BARR5HUMANATTITUDE1 to G1BARR5HUMANATTITUDE5 used the Likert scale where respondents would have to rate based on;

1: strongly disagree, 2: disagree, 3: neutral, 4: agree, 5 strongly agree.

No	Statement	1	2	3	4	5
G1	Bad human attitudinal in LCP has affected adoption of LCP.	0	1.4	2.9	18.0	77.7
G2	Poor leadership which is lead to employee resistance to implement has affected adoption of LCP	0	0	2.9	15.1	82.0
G3	Misunderstanding and doubt of unfamiliar practices by workers has affected adoption of LCP	0	0.7	2.9	19.4	77.0
G4	Effort to undergo brainstorming or lesson learn session during process flow has affected adoption of LCP	0	0.7	3.6	20.1	75.5
G5	Selfishness of professional to provide the experiences has affected adoption of LCP.	0	0	2.9	17.3	79.9

Table 4.8.1: Barrier of Human Attitude Data

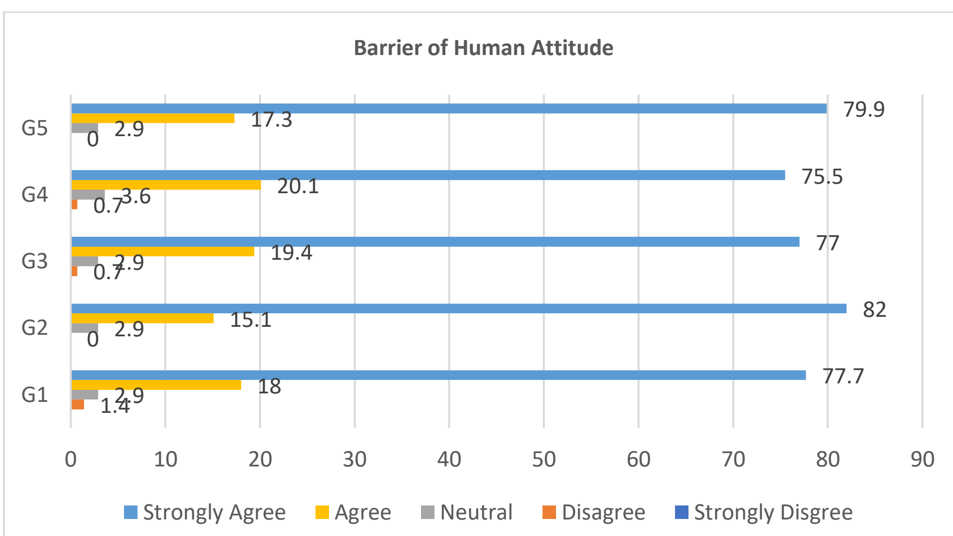

Figure 4.8.1: Barrier of Human Attitude Graph

Table 4.8.1 and Figure 4.8.1.1 above show the response garnered from all barrier of bad human attitudinal related-questions in Likert scale. The highest frequency of response was respondents in general question of G1 strongly agreeing 77.7 % that bad human attitudinal in LCP has affected adoption of LCP.

For G2 statement, 82.0 % strongly agree that poor leadership which is lead to employee resistance to implement has affected adoption of LCP, followed by G3 statement 77.0 % respondents strongly agreed that Misunderstanding and doubt of unfamiliar practices by workers has affected adoption of LCP, 75.5 % respondents also strongly agree towards the statement G4 that effort to undergo brainstorming or lesson learn session during process flow has affected adoption of LCP.

Lastly for G5 statement, 79.9 % of respondents strongly agree that selfishness of professional to provide the experiences has affected adoption of LCP.

Statistics

SUM_BARR_HUMAN_ATT

N	Valid	139
	Missing	0
Mean		23.7122
Median		25.0000
Std. Deviation		2.23037
Skewness		-2.192
Std. Error of Skewness		.206
Kurtosis		5.207
Std. Error of Kurtosis		.408
Minimum		14.00
Maximum		25.00

Table 4.8.2: Summation of Barrier in Human Attitudinal Data

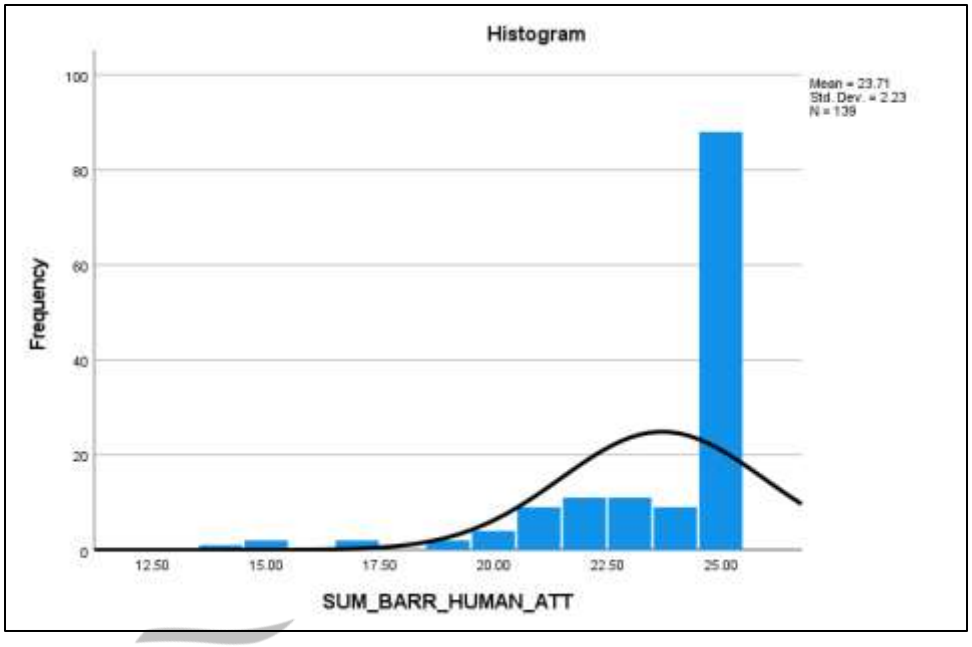

Figure 4.8.2: Distribution of Summation of Human Attitude

Table 4.8.2.and figure 4.8.2 showed the result of the distribution of the Barrier of Human Attitude questions with mean score of all the variable under this section is 23.71 and the median is 25, indicating that its right skewed (positively skewed) with skewness value of -2.20 and kurtosis value is 5.207.

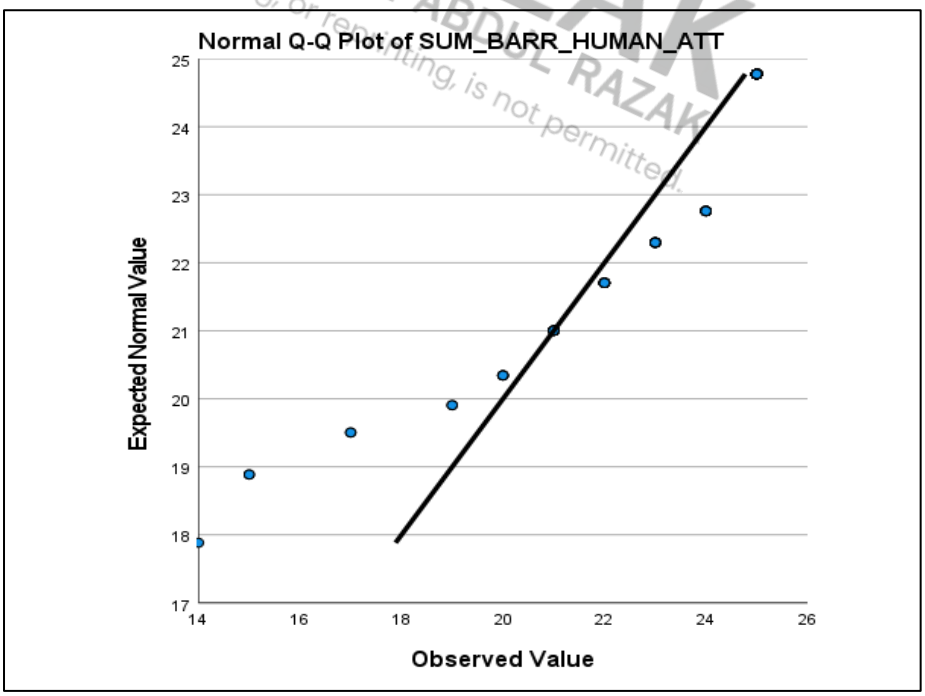

Figure 4.8.3: Distribution of Q-Q Plot for Summation of Barrier in Human Attitude

4.9 Section 8 : Safety Improvement

In Section 9, the questions in this section were closed ended 3 questions of DV1SAFETYPERFORM1 to DV3SAFETYPERFORM3 through an option of answer either Yes or No. Then, followed by 5 questions of DV4SAFETYPERFORM 4 to DV8SAAFETYPERFORM8 used the Likert scale where respondents would have to rate based on;

1: strongly disagree, 2: disagree, 3: neutral, 4: agree, 5 strongly agree.

The answers from this variable were separated and analyzed individually and summed up under one main section response. For question DV1SAFETYPERFORM1 to DV3SAFETYPERFORM3 descriptive analysis result as below:

DV2:SAFETYPERFORM

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	133	95.7	95.7	95.7
	No	6	4.3	4.3	100.0
	Total	139	100.0	100.0	

DV1:SAFETYPERFORM

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	133	95.7	95.7	95.7
	No	6	4.3	4.3	100.0
	Total	139	100.0	100.0	

DV3:SAFETYPERFORM

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	133	95.7	95.7	95.7
	No	6	4.3	4.3	100.0
	Total	139	100.0	100.0	

Table 4.9.1: Summary of Safety Improvement Data

Number	Statement	Yes (%)	No (%)
DV1	The LCP has improved safety in your organization.	95.7	4.3
DV2	The barriers in adopting LCP have affected the safety improvement in your organization	95.7	4.3
DV2	Management and government promotion in adopting LCP has affected the Organizational safety Improvement of your organization.	95.7	4.3

Table 4.9.2: Safety Improvement Data

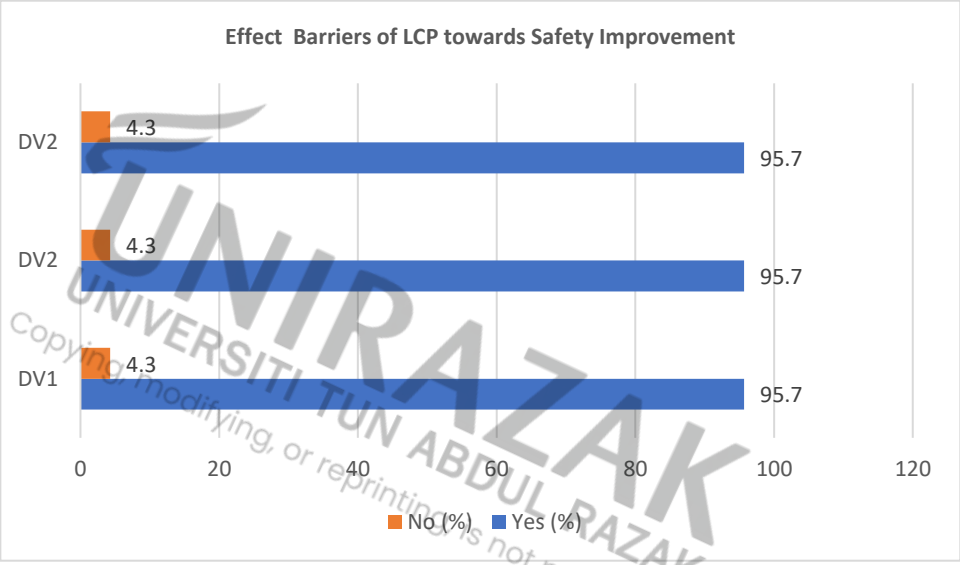

Figure 4.9.1: Safety Improvement Graph

The Dependent Variable (DV1 to DV3) related to safety improvement of construction site through LCP questions has been analyzed, surprisingly that 95.7 % of respondents equally agreed while only 4.3 % disagree that the LCP has improved safety in the organization, the barriers in adopting LCP have affected the safety Improvement in the organization, and management and government promotion in adopting LCP has affected the Organizational safety Improvement.

Proceed to the questions of DV4SAFETYPERFORM4 to DV8SAAFETYPERFORM8, in this section were all closed ended. used the Likert scale where respondents would have to rate based on;

1: strongly disagree, 2: disagree, 3: neutral, 4: agree, 5 strongly agree.

No	Statement	1	2	3	4	5
DV4	Has impositions of LCP in the workplace have been beneficial to safety Improvement in your organization?	0	0.7	3.6	12.9	92.7
DV5	Do you think the LCP of Prevention through Design (PtD) can prevent incident and improve safety at your workplace?	0	0.7	4.3	13.7	81.3
DV6	Do you think the LCP of Last Planner System (LPS) can prevent incident and improve safety at your workplace?	0	1.4	5.0	11.5	82.0
DV7	Do you think the LCP of visualization through warning signages can prevent incident and improve safety at your workplace?	0	1.4	3.6	13.7	81.3
DV8	Do you think the LCP of 5S through housekeeping can prevent incident and improve safety at your workplace?	0	0	4.3	10.1	85.6

Table 4.9.3: Safety Improvement Data (Likert scale)

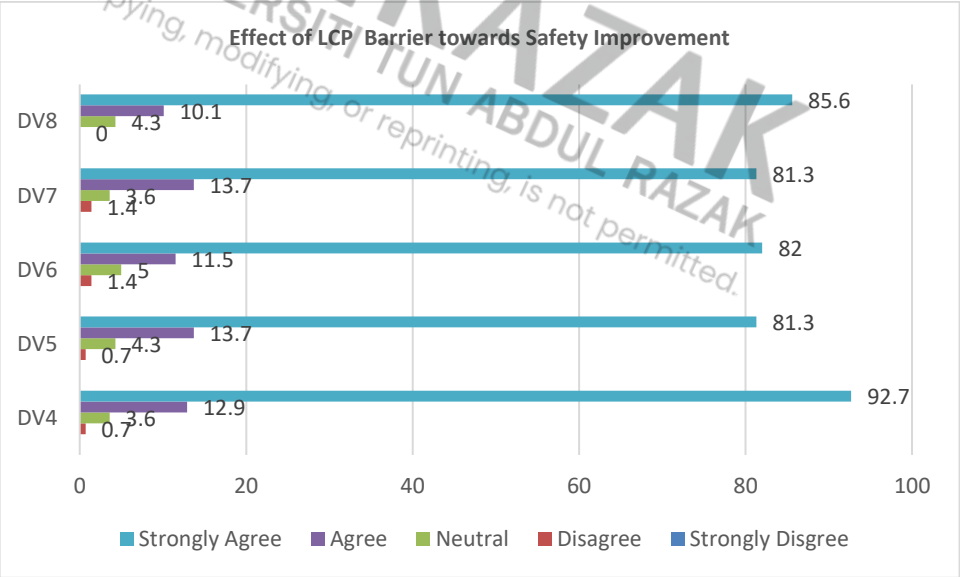

Figure 4.9.3: Safety Improvement Data

Table 4.9.3 and Figure 4.9.3 above show the response garnered from all effect of barrier in adopting LCP to improve safety related-questions in Likert scale.

The highest frequency of response was respondents in the question of DV4 strongly agreeing 92.7 % that the impositions of LCP in the workplace have been beneficial to safety Improvement in the organization. For DV5 statement, 81.3 % strongly agree that the LCP of Prevention through Design (PtD) can prevent incident and improve safety at workplace, followed by DV6 statement 82.0 % respondents strongly agreed that the LCP of Last Planner System (LPS) can prevent incident and improve safety at workplace, 81.3 % respondents also strongly agree towards the statement DV7 that LCP of visualization through warning signages can prevent incident and improve safety at workplace.

Lastly for DV8 statement, 85.6 % of respondents strongly agree that LCP of 5S through housekeeping can prevent incident and improve safety at workplace.

Statistics

SUM_IMPROVE_SAFETY

N	Valid	139
	Missing	0
Mean		26.9640
Median		28.0000
Std. Deviation		2.17832
Skewness		-2.480
Std. Error of Skewness		.206
Kurtosis		5.809
Std. Error of Kurtosis		.408
Minimum		18.00
Maximum		28.00

Table 4.9.4: Summation of Safety Improvement Data

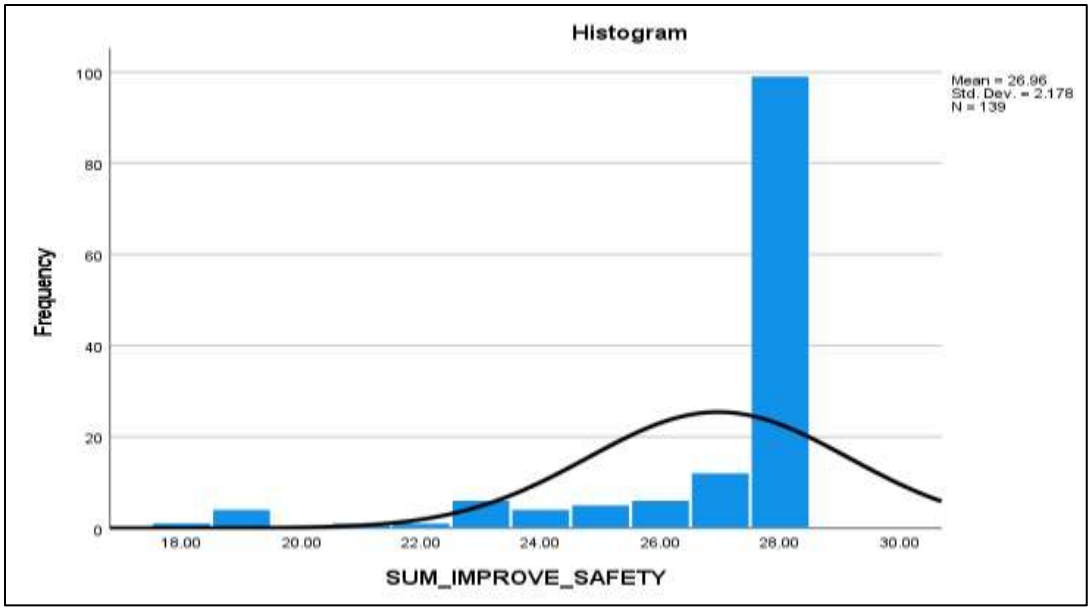

Figure 4.9.4: Distribution of Summation of Safety Improvement

Figure 4.9.4 showed the result of the distribution of Dependent Variable of Safety Improvement questions with mean score of all the variable under this section is 26.96 and the median is 28, indicating that its right skewed (positively skewed) with skewness value of -2.48 and kurtosis value is 5.81.

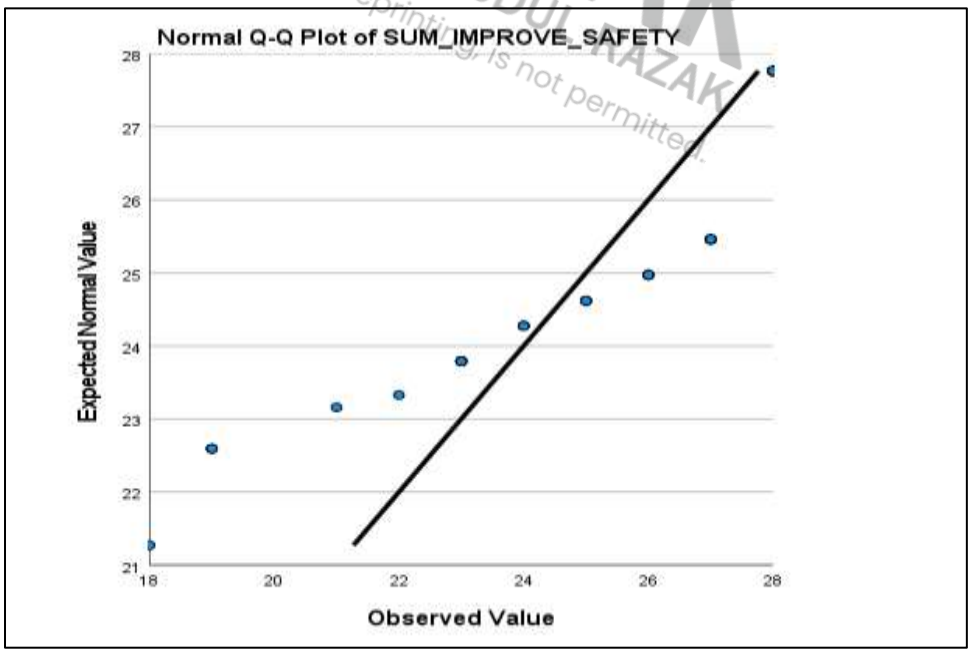

Figure 4.9.5.: Distribution of Q-Q Plot for Summation of Safety Improvement

4.10 Section 9: Strategies to Overcome the Barrier in Adopting LCP to Improve Safety.

In this section, respondents were asked if there are new strategies in tackling the barriers in adopting LCP to improve safety of construction site. The strategy questions in this section were closed ended with 1 (one) question in OPE 3 where respondents were allowed to choose multiple answer as listed below table.

STRATEGY	Definition
S1	Increase use of technology/digitalization in process flow such as BIM (Building Information Module)
S2	Minimize waste from incident, material, time, start from design stage till finish process.
S3	Innovation ideas in construction operation and construction cost in HIRARC or pre hazard analysis
S4	Increase awareness and share responsibility of management and stakeholders.
S5	Tighten safety risk management through LCP by government.
S6	Improve construction deliverables with the integration of LCP and Industrialized Building System(IBS)
S7	Involvement and sharing risk among the management and stakeholder
OTHER	Other than above

Table 4.10.1: Strategies Definition

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STRATEGIES	YES/NO	Frequency	Percent	Valid Percent	Cumulative Percent
S1	NO	100	71.9	71.9	71.9
	YES	39	28.1	28.1	100.0
S2	NO	40	28.8	28.8	28.8
	YES	99	71.2	71.2	100.0
S3	NO	10	7.2	7.2	7.2
	YES	129	92.8	92.8	100.0
S4	NO	6	4.3	4.3	4.3
	YES	133	95.7	95.7	100.0
S5	NO	133	95.7	95.7	95.7
	YES	6	4.3	4.3	100.0
S6	NO	138	99.3	99.3	99.3
	YES	1	0.7	0.7	100.0
S7	NO	138	99.3	99.3	99.3
	YES	1	0.7	0.7	100.0
OTHER	NO	138	99.3	99.3	99.3
	YES	1	.7	.7	100.0

Table 4.10.2: Strategies Distribution Data

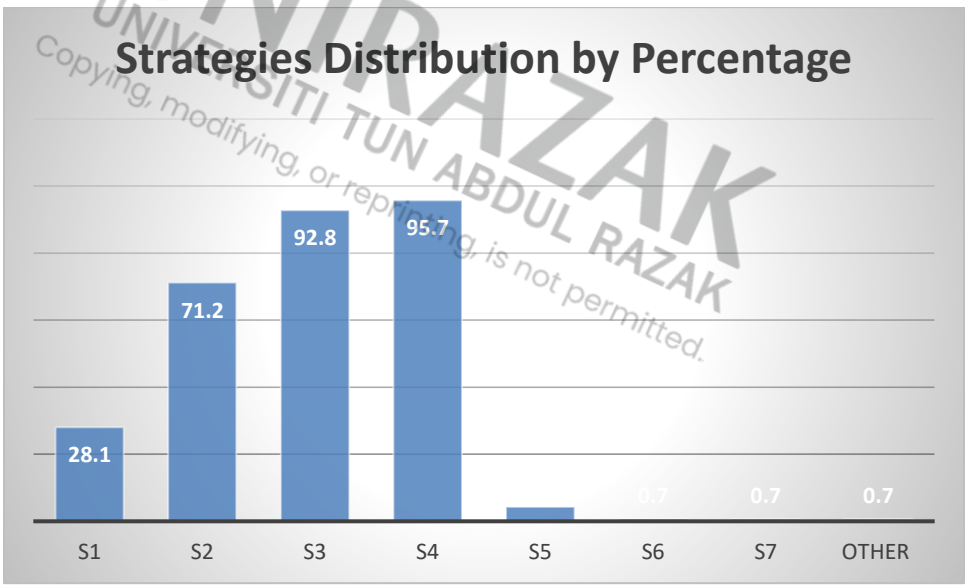

Figure 4.10.1: Distribution of Strategies Graph

Table 4.10.1, Table 4.10.2 and Figure 4.10.1 above show the response garnered from all opinions related to the strategies in adopting LCP to improve safety related-questions in multiple answer option.

The highest frequency of response was 95.7 % respondents in the question of

strategies proposed to increase awareness and share responsibility of management and stakeholders. The second strategy with 92.8 % frequency which is required innovation ideas in construction operation and construction cost in HIRARC or pre hazard analysis. The third strategy with frequency 71.2 % which required to minimize waste from incident, material, time, start from design stage till finish process, and followed by 28.1 % respondent also suggested to increase use of technology/digitalization in process flow such as BIM (Building Information Module) can prevent incident and improve safety at workplace,

While the remaining 3 strategies such as tighten safety risk management through LCP approach by government, improve construction deliverables with the integration of LCP and Industrialized Building System(IBS) as well as involvement and sharing risk among the management and stakeholder were not significantly preferred by the respondents.

Statistics

SUM_STRATEGIES

N	Valid	139
	Missing	0
Mean		2.9424
Median		3.0000
Std. Deviation		.95379
Skewness		.675
Std. Error of Skewness		.206
Kurtosis		4.706
Std. Error of Kurtosis		.408
Minimum		1.00
Maximum		8.00

Table 4.10.3. Summation of Strategies Data

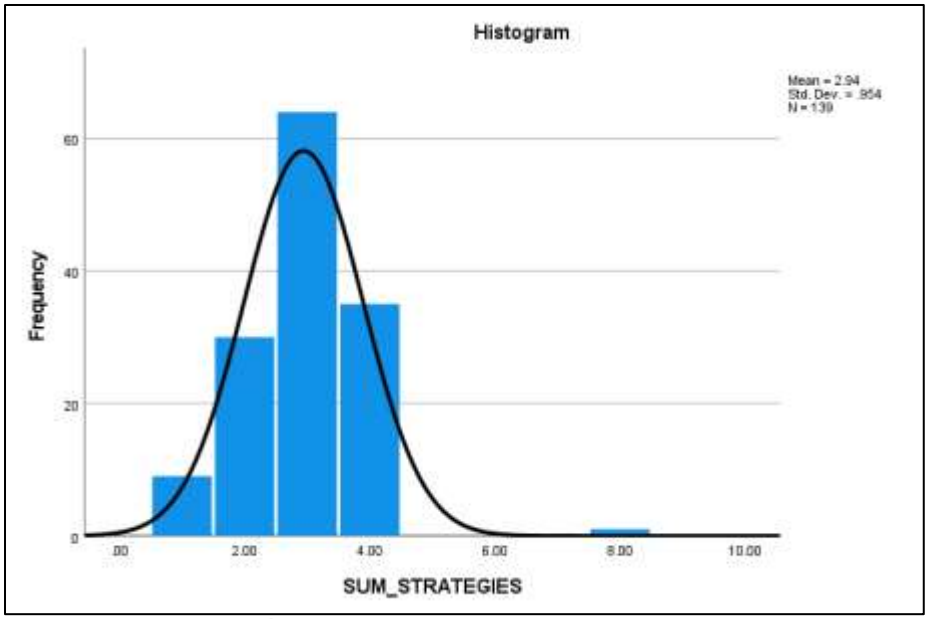

Figure 4.10.2: Distribution of Summation of Strategies

Table 4.10.3 and Figure 4.10.2 showed the result of the distribution of Strategies summation to overcome LCP Barrier for Safety Improvement questions with mean score of all the variable under this section is 2.94 and the median is 3.0, indicating that its right skewed (negatively skewed) with skewness value of 0.675 and kurtosis value is 4.71

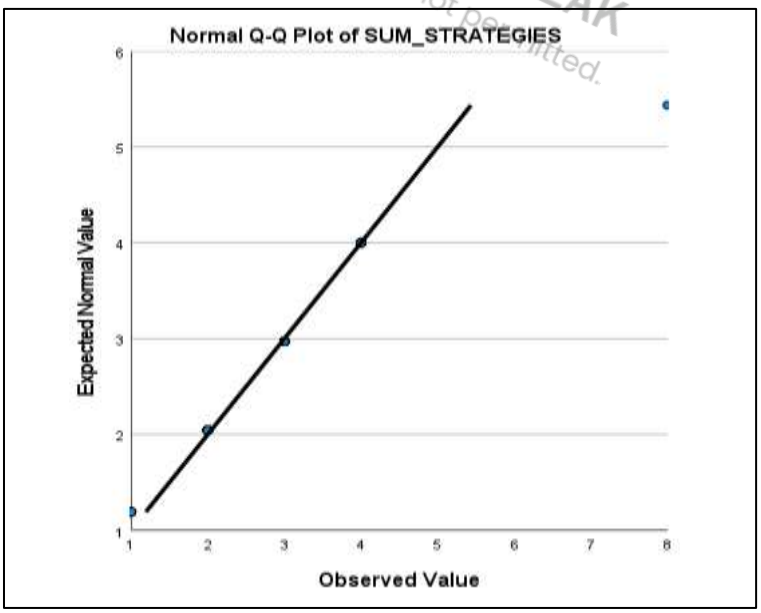

Figure 4.10.3: Q-Q Plot for Summation of Strategies

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
SUM_STRATEGIES	.243	139	<.001	.836	139	<.001

a. Lilliefors Significance Correction

Table 4.10.4: Test of Normality for Strategies Questions

The normality test as per table 4.10.4 above shows the significant level of this variable is at a correlation of < 0.01 level.

4.11 Section 10: Recommendation to Overcome the Barrier in Adopting LCP to Improve Safety

In this section, respondents were asked if there are new strategies in tackling the barriers in adopting LCP to improve safety of construction site. The strategy questions in this section were closed ended with 1 (one) question in RECOMMEND 3 where respondents were allowed to choose multiple answer as listed below table.

RECOMMENDATION	Definition
R1	Incentives stimulus package to LCP implemented by G7 contractors
R2	Develop society of Lean Contractor and prioritized in awarding job/mega project.
R3	Provide financial aids such as income tax relief/tax, incentive/ discount Stamp Duties to G7 contractors.
R4	Full Enforcement of the Guideline OSHCIM: Occupational Safety and Health in Construction Industry (Management) to the management and stakeholder.
R5	Continuous safety education program through LCP approach for all personnel in construction team
R6	Provide LCP Institute endorsed by government agencies: NIOSH, CIDB and DoSH.
OTHER	Other than above

Table 4.11.1: Classification of Recommendation

Recommenda-tion	YES/NO	Frequency	Percent	Valid Percent	Cumulative Percent
R1	NO	9	6.5	6.5	6.5
	YES	130	93.5	93.5	100.0
R2	NO	8	5.8	5.8	5.8
	YES	131	94.2	94.2	100.0
R3	NO	7	5.0	5.0	5.0
	YES	132	95.0	95.0	100.0
R4	NO	6	4.3	4.3	4.3
	YES	133	95.7	95.7	100.0
R5	NO	7	5.0	5.0	5.0
	YES	132	95.0	95.0	100.0
R6	NO	3	2.2	2.2	2.2
	YES	136	97.8	97.8	100.0
R7	NO	139	100.0	100.0	100.0
	YES	0	0	0	0
OTHER	NO	139	100.0	100.0	100.0
	YES	0	0	0	0

Table 4.11.2: Recommendation Data

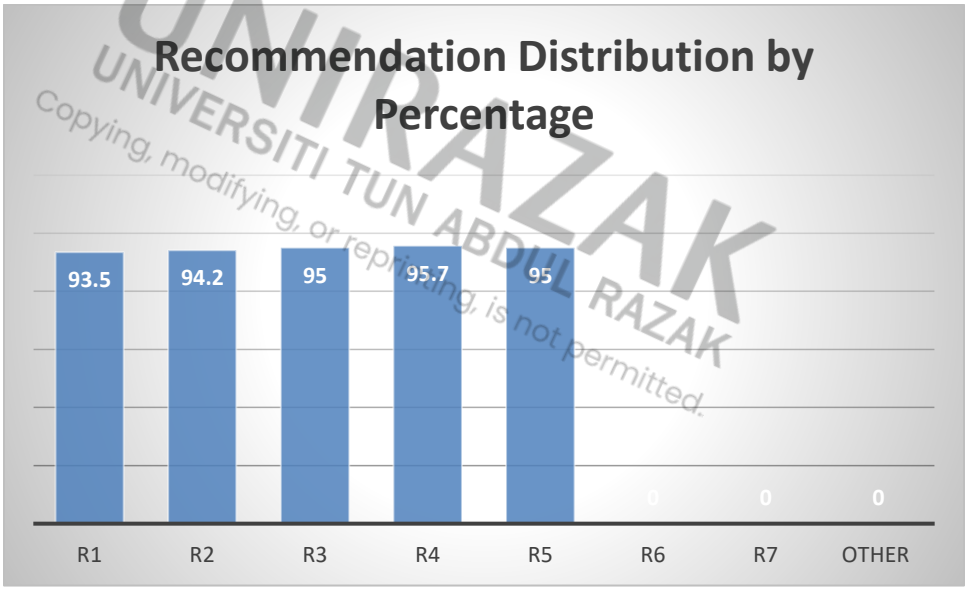

Figure 4.11.1: Summation of Recommendation to implement LCP for Safety Improvement

Table 4.11.1, Table 4.11.2. and Figure 4.11.1 above show the response garnered from all opinions related to the strategies in adopting LCP to improve safety related-questions in multiple answer option.

The table 4.11.1 above asks questions if there are any recommendation for the construction industry as a result of the barriers in adopting LCP to improve safety. The highest frequency is 95.7% where respondents propose to have full enforcement of the Guideline OSHCIM: Occupational Safety and Health in Construction Industry (Management), followed by 95.0 % for recommended to provide financial aids such as income tax relief/tax, incentive/ discount Stamp Duties to G7 contractors whom practicing LCP. The same percentage of 95% respondents recommended to provide platform for continuous safety education program through LCP approach for all personnel in construction team.

It was further demonstrated that 94.5 % respondents claim to develop association of Lean Contractor and prioritized in awarding job/mega project. Finally, 93.5 % selected an incentives stimulus package to LCP practitioner of G7 contractors.

Statistics

SUM_RECOMMEND

N	Valid	139
	Missing	0
Mean		5.7122
Median		6.0000
Std. Deviation		.96493
Skewness		-3.664
Std. Error of Skewness		.206
Kurtosis		13.310
Std. Error of Kurtosis		.408
Minimum		1.00
Maximum		6.00

Table 4.11.3. Table of Summation of Recommendation

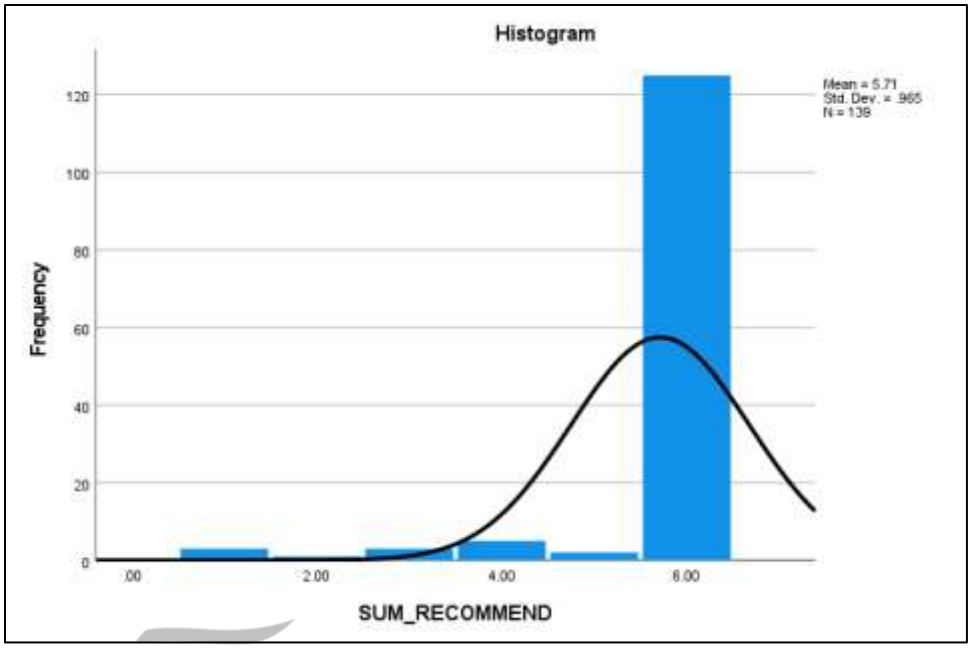

Figure 4.11.2: Distribution Summation of Recommendation Graph

Table 4.11.3 and Figure 4.11.2 showed the result of the distribution of recommendation summation to overcome LCP Barrier for with Safety Improvement questions mean score of all the variable under this section is 5.71 and the median is 6.0, indicating that its right skewed (negatively skewed) with skewness value of -3.66 and kurtosis value is 13.31.

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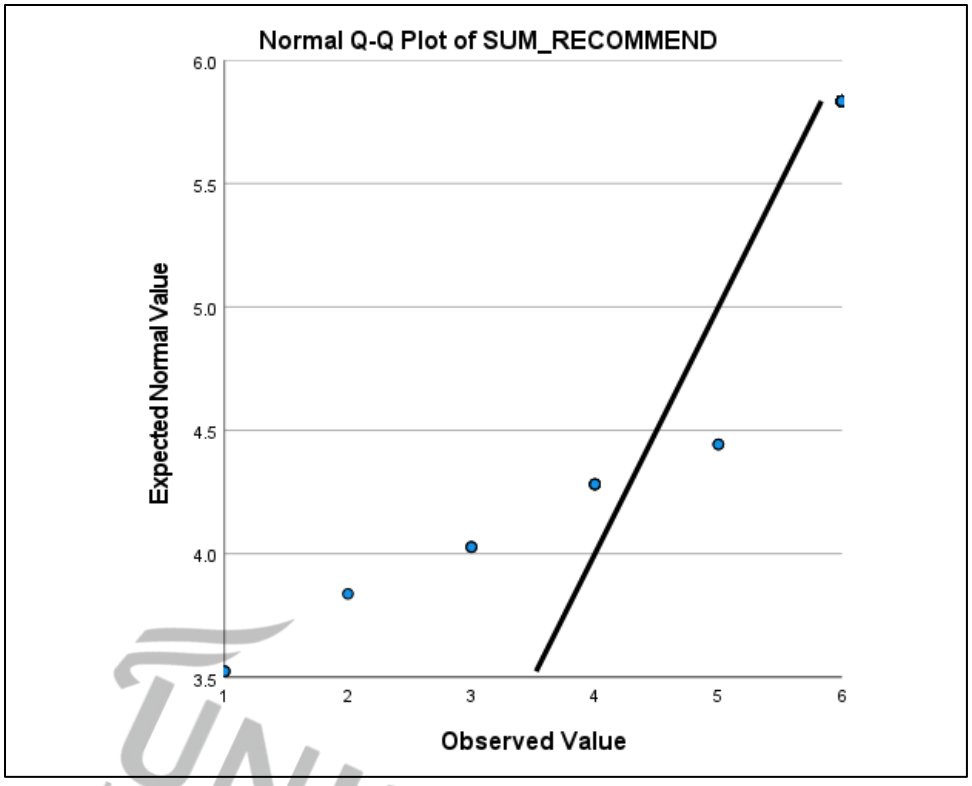

Figure 4.11.3: Q-Q Plot for Summation of Recommendation

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
SUM_RECOMMEND	.517	139	<.001	.334	139	<.001

a. Lilliefors Significance Correction

Table 4.11.4. Test of Normality for Summation of Recommendation.

The normality test as per table 4.11.4 above shows the significant level of this variable is at a correlation of < 0.01 level.

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4.11. Hypothesis Testing

Hypotheses testing was conducted to proof the individual hypothesis justifications. Chi Square test, Pearson Correlation and regression were conducted to justify the 5 (five) hypotheses as below: -

H_1: Lack of Management and Stakeholder Commitment impacts the adoption of LCP to improve safety of construction site.

H_2: Financial constraints impact the adoption of LCP to improve safety of construction site.

H_3: Lack of knowledge and skill impacts the adoption of LCP to improve safety of construction site.

H_4: Lack of Government support impacts the adoption of LCP to improve safety of construction site.

H_5: Bad human attitudinal impacts the adoption of LCP to improve safety of construction site.

H_6: Adoption of LCP impacted safety improvement of construction site.

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4.11.1. Chi-Square Test

4.11.1.1. Relationship between lack of management and stakeholder commitment and safety Improvement of construction site.

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
SUM_BARR_MGMT * SUM_IMPROVE_SAFETY	138	99.3%	1	0.7%	139	100.0%

Table 4.11.1.1: Chi-Square Test between Lack in Management and stakeholder support towards Safety Improvement

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	526.823[a]	99	<.001
Likelihood Ratio	135.063	99	.009
Linear-by-Linear Association	64.910	1	<.001
N of Valid Cases	138		

a. 114 cells (95.0%) have expected count less than 5. The minimum expected count is .01.

Table 4.11.1.2: Chi-Square Test between lacking in management and stakeholder support and Safety Improvement.

Based on table 4.11.1 above, the P- value is recorded below 0.05. The results are considered significant if the P-value is equal or less that the alpha level which is 0.01.In this study, it is asserted that the relationship between the barrier of lacking in management and stakeholder support and safety Improvement is significant as the P-value is lesser than alpha value, and associated each other.

4.11.2. Relationship between barrier of financial constraint and safety Improvement.

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
SUM_ORGPER * SUM_OPE	122	100.0%	0	0.0%	122	100.0%

Table 4.11.2.1.: Chi-Square Test between Barrier in Financial Constraint and Safety Improvement

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	228.177[a]	72	<.001
Likelihood Ratio	103.183	72	.009
Linear-by-Linear Association	79.694	1	<.001
N of Valid Cases	139		

a. 86 cells (95.6%) have expected count less than 5. The minimum expected count is .01.

Table 4.11.2.2.: Chi-Square Test between Barrier in Financial Constraint and Safety Improvement

Based on table 4.11.2.2 above, the P- value is recorded below 0.05. The results are considered significant if the P-value is equal or less that the alpha level which is 0.01.In this study, it is asserted that the relationship between barrier of financial constraint and Safety Improvement is significant as the P-value is lesser than alpha value and are therefore associated with each other.

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4.11.3. Relationship between Lack in Educational and Skill towards Safety Improvement

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
SUM_BARR_SKILL * SUM_IMPROVE_SAFETY	137	98.6%	2	1.4%	139	100.0%

Table 4.11.3.1: Chi-Square Test between Barrier of Lack in Education and Skill towards Safety Improvement

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	590.258[a]	144	<.001
Likelihood Ratio	158.191	144	.198
Linear-by-Linear Association	82.268	1	<.001
N of Valid Cases	137		

a. 167 cells (98.2%) have expected count less than 5. The minimum expected count is .01.

Table 4.11.3.2: Chi-Square Test between Lack of Education and Skill towards Safety Improvement

Based on table 4.11.3.1 and Table 4.11.3.2 above, the P- value is recorded below 0.05. The results are considered significant if the P-value is equal or less that the alpha level which is 0.05.In this study, it is asserted that the relationship between lacking in educational and skill and Safety Improvement is significant as the P-value is lesser than alpha value and are therefore associated with each other.

4.11.4. Relationship between Lack of Government Support towards Safety Improvement

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
SUM_BARR_GOVSUPP * SUM_IMPROVE_SAFETY	139	100.0%	0	0.0%	139	100.0%

Table 4.11.4.1: Chi-Square Test between Barrier of Lack in Government Support and Safety Improvement

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	455.093[a]	99	<.001
Likelihood Ratio	148.632	99	<.001
Linear-by-Linear Association	90.851	1	<.001
N of Valid Cases	139		

a. 115 cells (95.8%) have expected count less than 5. The minimum expected count is .01.

Table 4.11.4.2: Chi-Square Test between Lack of Government Support towards Safety Improvement

Based on table 4.11.4 above, the P- value is recorded below 0.05. The results are considered significant if the P-value is equal or less that the alpha level which is 0.01.In this study, it is asserted that the relationship between lacking in government support and Safety Improvement is significant as the P-value is lesser than alpha value and are therefore associated with each other.

4.11.5. Relationship between Human Attitude towards Safety Improvement

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
SUM_BARR_HUMAN_ATT * SUM_IMPROVE_SAFETY	139	100.0%	0	0.0%	139	100.0%

Table 4.11.5.1: Chi-Square Test between Barrier of Human Attitude and Safety Improvement

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	396.117[a]	81	<.001
Likelihood Ratio	133.049	81	<.001
Linear-by-Linear Association	86.091	1	<.001
N of Valid Cases	139		

a. 94 cells (94.0%) have expected count less than 5. The minimum expected count is .01.

Table 4.11.5.2: Chi-Square Test between Human Attitudinal and Safety Improvement

Based on table 4.11.5 above, the P- value is recorded below 0.05. The results are considered significant if the P-value is equal or less that the alpha level which is 0.01.In this study, it is asserted that the relationship between human attitudinal and Safety Improvement is significant as the P-value is lesser than alpha value and are therefore associated with each other.

4.11.6. Relationship between LCP Adoption towards Safety Improvement

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
SUM_LCP_AWARENESS * SUM_IMPROVE_SAFETY	139	100.0%	0	0.0%	139	100.0%

Table 4.11.6.1: Chi-Square Test between LCP Awareness and Safety Improvement

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	199.921[a]	45	<.001
Likelihood Ratio	69.269	45	.012
Linear-by-Linear Association	25.446	1	<.001
N of Valid Cases	139		

a. 57 cells (95.0%) have expected count less than 5. The minimum expected count is .01.

Table 4.11.6.2: Chi-Square Test between LCP Awareness and Safety Improvement

Based on table 4.11.6 above, the P- value is recorded below 0.05. The results are considered significant if the P-value is equal or less that the alpha level which is < 0.01.In this study, it is asserted that the relationship between LCP adoption and Safety Improvement is significant as the P-value is lesser than alpha value and are therefore associated with each other.

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4.12. Pearson's Correlation.

The strength of the linear link between two variables, is measured by correlation coefficients. A positive link is shown by a linear correlation coefficient greater than zero (> 0.00) and a negative association is indicated by a value smaller than zero (< 0.00). For continuous data scales, the correlation coefficient ranges from -1 to +1.

Table 4.12.1 below shows the relationship between the Independent Variable which are new safety regulation, operational effectiveness and financial efficiency with thedependent variable which is Organizational Improvement

Correlations

		SUM_BARR_MGMT	SUM_BARR_FINANCE	SUM_BARR_SKILL	SUM_BARR_GOVSUPP	SUM_BARR_HUMAN_ATT	SUM_IMPROVE_SAFETY
SUM_BARR_MGMT	Pearson Correlation	1	.829**	.885**	.790**	.741**	.688**
	Sig. (2-tailed)		<.001	<.001	<.001	<.001	<.001
	N	138	138	136	138	138	138
SUM_BARR_FINANCE	Pearson Correlation	.829**	1	.876**	.802**	.814**	.760**
	Sig. (2-tailed)	<.001		<.001	<.001	<.001	<.001
	N	138	139	137	139	139	139
SUM_BARR_SKILL	Pearson Correlation	.885**	.876**	1	.889**	.812**	.778**
	Sig. (2-tailed)	<.001	<.001		<.001	<.001	<.001
	N	136	137	137	137	137	137
SUM_BARR_GOVSUPP	Pearson Correlation	.790**	.802**	.889**	1	.835**	.811**
	Sig. (2-tailed)	<.001	<.001	<.001		<.001	<.001
	N	138	139	137	139	139	139
SUM_BARR_HUMAN_ATT	Pearson Correlation	.741**	.814**	.812**	.835**	1	.790**
	Sig. (2-tailed)	<.001	<.001	<.001	<.001		<.001
	N	138	139	137	139	139	139
SUM_IMPROVE_SAFETY	Pearson Correlation	.688**	.760**	.778**	.811**	.790**	1
	Sig. (2-tailed)	<.001	<.001	<.001	<.001	<.001	
	N	138	139	137	139	139	139

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

Table 4.12.1: Pearson's Correlation between Independent and Dependent Variable

As shown on figure 4.12.1 above, the Pearson correlation for Barrier of Management and Stakeholder (MGMT) is r = 0.688 and 1 indicates a perfect positive linear relationship between variables. As resulted correlation is significant at the 0.01 level; (r = 0.688, n = 138, p = <.001).

The Pearson correlation for barrier in Financial Constraint is r = 0.760 and 1 indicates aperfect positive linear relationship between variables. As resulted correlation is significant at the 0.01 level; (r = 0.760, n = 122, p = <.001).

The Pearson correlation for barrier of lack in education and skill r = 0.778 and 1 indicates a perfect positive linear relationship between variables. As resulted correlation is significant at the 0.01 level; (r = 0.778, n = 122, p = <.001).

The Pearson correlation for barrier of lack in Government Support is r = 0.811 and 1 indicates aperfect positive linear relationship between variables. As resulted correlation is significant at the 0.01 level; (r = 0.811, n = 122, p = <.001).

The Pearson correlation for barrier of human attitudinal r = 0.790 and 1 indicates a perfect positive linear relationship between variables. As resulted correlation is significant at the 0.01 level; (r = 0.790, n = 122, p = <.001).

4.13. Multiple Regression Analysis

4.13.1. Test of Normality

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
SUM_BARR_MGMT	.333	136	<.001	.594	136	<.001
SUM_BARR_FINANCE	.396	136	<.001	.604	136	<.001
SUM_BARR_SKILL	.368	136	<.001	.593	136	<.001
SUM_BARR_GOVSUPP	.363	136	<.001	.601	136	<.001
SUM_BARR_HUMAN_ATT	.358	136	<.001	.645	136	<.001
SUM_IMPROVE_SAFETY	.394	136	<.001	.543	136	<.001

a. Lilliefors Significance Correction

Table 4.13.1: Test of Normality of All Variables with Dependent Variable

The normality test shown on table 4.13.1 above shows the significant level of:

i. Barrier of Lack in Management and Stakeholder (BARR MGMT) variable are at a correlation of < 0.05 level. Therefore,the null hypothesis is rejected;

ii. Barrier of Financial Constraint (BARR FINANCE) variable, it is at a

correlation of < 0.05 level. Therefore, the null hypothesis is rejected;

iii. Barrier of Lack in Education and Skill (BARR SKILL) variable, it is at a correlation of < 0.05 level. Therefore, the null hypothesis is rejected;

iv. Barrier of Lack in Government Support (BARR GOVSUPP) variable, it is at a correlation of < 0.05 level. Therefore, the null hypothesis is rejected;

v. Barrier of Human Attitudinal (BARR HUMAN ATT) variable, it is at a correlation of < 0.05 level. Therefore, the null hypothesis is rejected;

4.13.2. Model Summary.

The strength of the association between the model and the dependent variable is reported in the model summary table 4.13.2 below. The linear correlation between the observed and model-predicted values of the dependent variable is representedby R, the multiple correlation coefficient. Its high value denotes a strong connection.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.843[a]	.711	.700	1.18977

a. Predictors: (Constant), SUM_BARR_HUMAN_ATT, SUM_BARR_MGMT, SUM_BARR_GOVSUPP, SUM_BARR_FINANCE, SUM_BARR_SKILL

Table 4.13.2.1: Model Summary

The squared value of the multiple correlation coefficient is R Square, the coefficientof determination. It reveals that 70.0 % percent of the variation in time or as can beseen in the adjusted R-square; 70.0 % has been explained.

4.13.3. ANOVA Analysis

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	452.913	5	90.583	63.991	<.001[b]
	Residual	184.021	130	1.416		
	Total	636.934	135			

a. Dependent Variable: SUM_IMPROVE_SAFETY

b. Predictors: (Constant), SUM_BARR_HUMAN_ATT, SUM_BARR_MGMT, SUM_BARR_GOVSUPP, SUM_BARR_FINANCE, SUM_BARR_SKILL

Table 4.13.2.2: ANOVA Analysis

As can be referred from figure, it is proven that there is a significant value of 0.00 (p= ≤0.01) which is below 0.05. Therefore, there is a statistically significant difference between the means of all independent variable and the dependent variable.

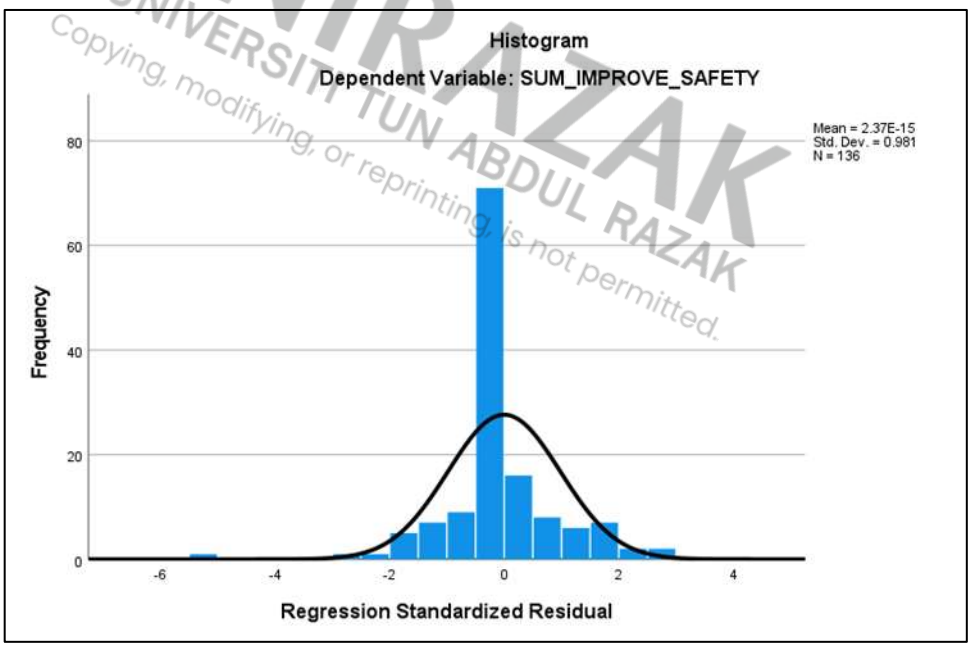

Figure 4.13.3: ANOVA Analysis

Figure 4.13.3 showed the result of the distribution of the ANOVA figures of independent variable which are barrier of lacking in management and stakeholder commitment, barrier of financial constraint, barrier of lacking in education and skill, barrier lacking in government support and barrier of human attitude with the dependent variable safety improvement. The mean score of all the variable under this section and the median is symmetry to which indicates a normal distribution with no skew.

4.13.4. Coefficients.

The next step, the analysis of the value of coefficients for these models. The valuesare given in figure 4.13.6 below

Coefficients[a]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	8.213	1.094		7.506	<.001
	SUM_BARR_MGMT	-.073	.078	-.097	-.932	.353
	SUM_BARR_FINANCE	.150	.096	.171	1.565	.120
	SUM_BARR_SKILL	.082	.074	.161	1.103	.272
	SUM_BARR_GOVSUPP	.269	.099	.322	2.725	.007
	SUM_BARR_HUMAN_ATT	.315	.097	.327	3.248	.001

a. Dependent Variable: SUM_IMPROVE_SAFETY

Table 4.11.4: Coefficients

Based on figure above, the following is derived:

i. The coefficient for barrier of lacking in management and stakeholder commitment (BARR_MGMT)) which is -0.073 is not statisticallysignificant from 0 using alpha of 0.05 because its p-value is 0.353 which is greater

than 0.05;

ii. The coefficient for barrier of financial constraint (BARR_FINANCE) which is 0.15 is not statistically significant from 0 using alpha of 0.05 because its p-value is 0.12, which is greater than 0.05.

iii. The coefficient for barrier of lack in educational and skill (BARR_SKILL) which is 0.082 is not statistically significant from 0 using alpha of 0.05 because its p-value is 0.2,which is greater than 0.05.

iv. The coefficient for barrier of lack in government support (BARR_GOVSUPP) which is 0.269 is not statistically different from 0 using alpha of 0.05 because its p-value is 0.007,which is smaller than 0.05.

v. The coefficient for barrier of human attitudinal (BARR_HUMAN_ATT) which is 0.315 is not statistically different from 0 using alpha of 0.05 because its p-value is 0.001,which is smaller than 0.05.

In summary, the barrier of lack in government support and human attitudinal respectively has the most significance impact towards safety improvement compared to barrier of management and stakeholder commitment, financial constraint and also barrier lack in education and skill.

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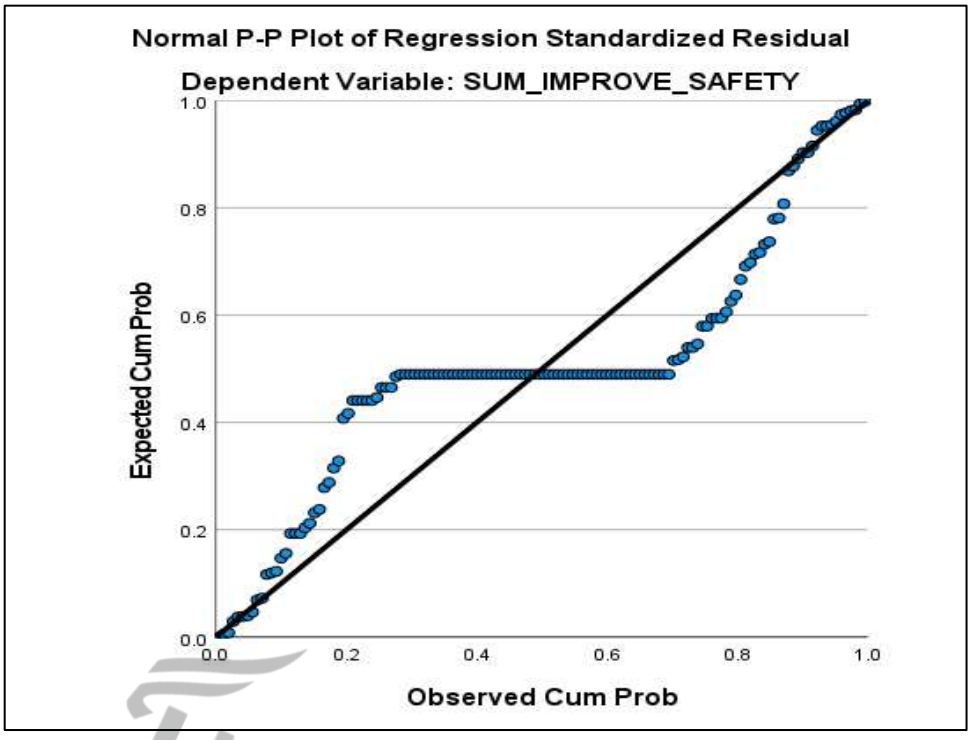

Figure 4.11.2 :P-P Regression Plot

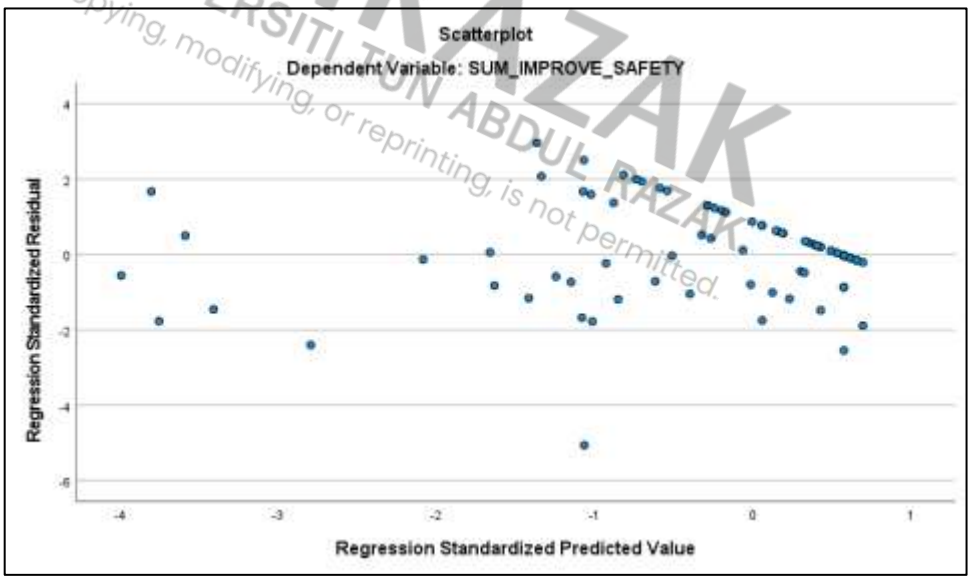

Figure 4.11.3 :P-P Regression Scatter Plot

4.14. Summary

As a result of the correlations significant, the researcher was able to determine that all of the relationships are in a good and strong position, indicating that the relationships are positively excellent and strong. Furthermore, all of the IVs are statistically significant (p-value) at 0.001. This means the first Research Objectives and Research Questions have been answered. The researcher also revealed which IVs have a substantial impact on the DV. The researcher used regression analysis to see the coefficient correlation analysis in identifying the relationship between the independent factors and the dependent variable in order to answer the first research aim.

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CHAPTER 5

CONCLUSION AND RECOMMENDATION

5.1. Introduction.

This chapter will discuss the outcomes or results derived from Chapter 4. All data collected was analyzed to access the objective reliability, importance of thevariables as well as the prominent factors which contributes towards the hypothesis. All results were analyzed via SPSS software and then it was summarized accordingly. In addition, the research implications help to demonstrate the need of researching solutions to the recognized problem as well as the study's relevance to other parties.The limits of the analysis have also been identified and investigated.

The questionnaires also involved asking the respondents if there was any positive outcome due to the barrier of LCP (SUMM 1) and suggestions of how the Government could step up and assist in adopting LCP to improve safety of G7 contractors in Kuala Lumpur and Selangor.

Finally, practical recommendations were made, and the study came to a close withresearch ideas for the future researches.

5.2. Conclusion.

The first issue is to find out if the barriers in adopting LCP had affected the safety Improvement of G7 contractors in Kuala Lumpur and Selangor. This was followed by probe into government support influence on safety improvement and finally if human attitudinal has affected the safety Improvement of those G7 contractors. Questionnaires were created based

on these 5 (five) issues of LCP barriers, and its affect towards safety improvement and a survey was conducted.

From data collected, 4 (four) crucial areas were tested and hypothesis were confirmed and accepted. Conclusions were drawn from these six (six) hypotheses, and this information also aided in the construction of the suggestions.

The individual chi-square test value for all 5 (five) independent variables namely

i. barrier of management and stakeholder commitment (BARR_MGMT),
ii. barrier of financial constraint (BARR_FINANCE),
iii. barrier of lack in education and skill (BARR_SKILL),
iv. barrier of lack in government support (BARR_GOVERN_SUPP), and
v. barrier of human attitude (BARR_HUMAN_ATT)

has resulted in alpha value below 0.05 which asserted that all the variables are significant to the dependent variable which is the safety improvement of G7 contractors in Kuala Lumpur and Selangor. Results based upon the Pearson correlation analysis too, all variable shows significant linear relationship of p-value ≤ 0.001 level. This results too proven to be supporting the hypothesis of factors effecting the safety Improvements.

In regards to the model summary R-square value, it reveals that 71.1 % percent of the variation in time or as can be seen in the adjusted R-square; 70.0 % has been explained. This means that only between 70 % to 71% of the independent variable are explaining about the dependent variable. However, researcher is confident that all variable included are unique

contributions towards this research and since the topic chosen which is barrier in adopting LCP to improve safety of construction site which is relatively well known in established country such as USA, UK and Europe and with unlimited studies that have been carried out, its normal to have a high level of r-square at this point of research.

Furthermore, the results from the ANOVA are positive and significant with p-value ≤ 0.001 level which is below the alpha value of 0.05. Finally, the coefficient levels show normal distribution levels with the barrier of lacking in government support and human attitude having the most significance impact towards safety of construction site.

Succinctly, the research's bullish forecast shows that the barrier in adopting LCP havea substantial impact on the safety improvement of construction site in Kuala Lumpur and Selangor.

5.3. Recommendations of the Study

The researcher also asked questions related to positive impacts on how the LCP may have on the construction site and the most feedback obtained surprisingly was 95.7 % stating to increase awareness and share responsibility of management and stakeholders., followed by innovation ideas in construction operation and construction cost in HIRARC or pre hazard analysis, minimize waste from incident, material, time, start from design stage till finish process and lastly to encourage application of technology/digitalization in process flow such as BIM (Building Information Module). This further proves that management of the organization is an essential factor in strengthening their strategies of implementation of LCP in order to improve safety of construction site. The barrier of adopting LCP is noteworthy with the employers' understanding to reduce the impact in both

states.

5.4. Recommendation to Future Researches

Ultimately, in opinions sections under question asking how can the Government assist in reducing the barrier in adopting by G7 contractors, inevitably 95.7 % respondents requested for full enforcement of the Guideline OSHCIM: Occupational Safety and Health in Construction Industry (Management) to the management and stakeholder, 95% opted for both recommendation to provide financial aids such as income tax relief/tax and continuous safety education program through for all personnel in construction team of G7, both of approaches are in direct correlation with financial struggles, which further concludes the strongest determining variable of Financial Efficiency effect on adoption in order to improve safety Improvement. These findings will aid policy-maker in improving existing strategic plans and developing new policies to deal with the consequences of barriers in adopting to improve safety in the construction industry. This is because, the issue of safety and wellbeing in construction site have a substantial impact on sustainability of construction industry development as well as socioeconomic growth.

The G7 contractor as construction industry players and government as policy maker should collaborate and work together in providing safe working condition. As an example, the development of Malaysian Lean Contractor Association in providing platform for knowledge and ideas exchange on how the LCP can bring benefit for both sides. The potential benefit may include to securing job or project award and incentive stimulus financial package to the G7 Contractor. Besides that, government agencies such as JKR, NIOSH, CIDB and DoSH should develop comprehensive and continuous safety education program through LCP for all personnel in construction team.

In addition, strong support from the government also important in providing training center such as LCP Institute (LCPI). LCPI's safety resource training should include safety in construction, safety in design and forum and convention focusing on particular safety issue on the job site.

Therefore, the barriers in adopting LCP to improve safety of construction site should be resolved accordingly in support of a need to focus more on workplace safety. Ultimately, the development of adequate buildings and infrastructure can assure national economic stability, job development, community cohesiveness, and improved living conditions.

There are a few recommendations to future researches as follows:

In-depth study on how technologies such as building information modelling (BIM) as these technologies can help increase workers productivity as well as ensuring their health, well-being, and safety in the construction industry because of pre hazard analysis at design stage is required. These technologies are predicted to persist and evolve but yet to be widely applied in Malaysian's construction industry.

i. In-depth study on common practice of how does a construction industry in Malaysia adopt its internal control policies in LCP practice and manage its possible contract prices, cost increase, safety methodology and all related in order to improve project and safety Improvement, improve collaboration, and complete projects on schedule and on budget, resulting in improved profit margins.
ii. In-depth study of all kind of LCP and its barrier in adopting in order to improve safety of construction site during the pre-construction as well as ongoing construction process and post construction process through the monitoring of the effectiveness in reducing waste impact form occurrence of incident.
iii. In-depth study of how the Government can provide aid to construction

industries in Malaysia especially by the way of LCP provisions in construction contracts such as awarding them either to the company or management and stakeholder.

iv. In-depth study on adequate and sufficient of time frame in the work program which involve in improving safety contributory factors or Safety Control Structure for construction industry in Malaysia.

5.5. Limitation of Research

i. As the population sample selected are employees from managerial level and above, getting them to respond to the questionnaire was challenging;

ii. Since the population sample selected was niche (Construction team only), thereby it was challenging in order to obtain a high number of respondents. Most of the respondents with experience in construction more than 5 years would be able to understand the term of LCP and safety issue in construction site.

iii. Research title focus mainly on G7 grade contractors in Kuala Lumpur and Selangor only which further limits diversity of respondents which could have been all classes of contractors;

iv. During the time of research, many companies in Kuala Lumpur and Selangor reluctant to accept face to face interviews, and questionnaire responses received was rather slow-moving.

v. Low of awareness and limited researches and study materials related to LCP in Malaysia and its implications on construction sector. Those that are available are done in other countries, that too very minimal numbers.

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APPENDICES

APPENDIX A

SITI ROSNAH BINTI SALMAN

MBA -THESIS QUESTIONNAIRES

* Required

UNIRAZAK
UNIVERSITI TUN ABDUL RAZAK

The Barriers in Adopting Lean Construction Principle (LCP) in Selangor and Kuala Lumpur.

Dear Value Respondents,

I am inviting you to participate in this research by completing the following survey for my research entitled " The Barriers in Adopting LCP In Selangor and Kuala Lumpur".

In the research paper, LCP which have been selected are considered the most important elements in construction industry such as Prevention through Design (PtD), Last Planner System (LPS), visualization (warning signage) and 5S(housekeeping). The objective of this study is to identify the barriers in adopting LCP to improve safety of G7 category construction sector, specifically in Selangor and Kuala Lumpur, by including various factors not limited to management and stakeholder, financial, knowledge and skill, government and also human attitudinal. Therefore, we need to address these barriers accordingly in order to improve safety and preserve the mandate of employability, opportunities and mass growth of overall economic at large.

The following questionnaire will take approximately up to 15 minutes to complete. I hope I will not be causing you any offense and I really appreciate for your sincere opinion in answering this survey. Lastly, I will make sure that the data collected will remain strictly confidential and used solely for academic purposes.

Thank you.

Regards,
Siti Rosnah Salman
Masters of Business Administration
(Majoring in Safety and Health, Environment)
Graduate School of Business
Universiti Tun Abdul Razak, Kuala Lumpur

Section 1: Demographic Profile

1. Gender *

Mark only one.

- [ ] Female
- [ ] Male

2. Age Group *

Mark only one

- [ ] 21-30
- [ ] 31-40
- [ ] 41-50
- [ ] 51-60
- [ ] above 60

3. Ethnicity *

Mark only one

- [ ] Malay
- [ ] Chinese
- [ ] Indian
- [ ] Other: _____

4. Highest Level of Education *

Mark only one

- [ ] Secondary/Diploma
- [ ] Bachelor's Degree
- [ ] Master's Degree Ph.D.
- [ ] Other Professional Qualification
- [ ] Other _____

5. Field of Study *

Mark only one.

- [ ] Accounting and Finance
- [ ] Business Management/Administration
- [ ] Contract/Quantity Surveying
- [ ] Engineering Safety and Health
- [ ] Other: _____

6. Area of work place *

Mark only one.

- [ ] Kuala Lumpur
- [ ] Selangor
- [ ] Other: _____

7. Professional Role At Work Place *

Mark only one.

- [ ] Top Management
- [ ] Managerial (Office)
- [ ] Project Manager (Construction Site)
- [ ] Health & Safety
- [ ] Executive/Engineer
- [ ] Supervisor
- [ ] Other: _____

8. Which Department Are You Working for *

Mark only one

- [ ] ManagementProject
- [ ] Accounts and Finance
- [ ] Contract
- [ ] Purchasing / Procurement
- [ ] Safety and Health
- [ ] Other: _____

9. Years of Experience in Construction Industry *

Mark only one

- [ ] Below 5 years
- [ ] Between 6 to 10 years
- [ ] Between 11 to 20 years
- [ ] 20 years and above

10. Average Monthly Income *

Mark only one.

- [ ] Below RM 5000
- [ ] Between RM 5001 - RM 10000
- [ ] Between RM 10001 - RM 20000
- [ ] RM 20000 above

Section 2: General Awareness and Barrier in LCP

11. Does your organization implement Prevention through Design (PtD) at your construction sites before commencing work?*

Mark only one.

- [ ] Yes
- [ ] No

12. Does your organization implement Last Planner System (LPS) at your construction sites before and during commencing work?*

Mark only one.

- [ ] Yes
- [ ] No

13. Does your organization implement Visualization System (Signages and warning system) at your construction sites?*

Mark only one

- [ ] Yes
- [ ] No

14. Does your organization implement 5S(Housekeeping system) at your construction sites?*

Mark only one

- [ ] Yes
- [ ] No

15. Does your organization aware that LCP can improve safety at your construction sites?*

Mark only one

- [ ] Yes
- [ ] No

Section 3: Management and Stakeholder Barriers

16. Lack of commitment from management and stakeholders has affected adoption of LCP*

Mark only one.

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

17. Management's and stakeholder's provision of assessment such as Pre task hazard analysis or Hazard Identification Risk Analysis and Risk Control in construction site has affected adoption of LCP*

Mark only one.

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

18. Management and stakeholder provision of Standard Operating Procedure in the Method Statement before work commencing has affected adoption of LCP*

Mark only one.

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

19. Management and stakeholder provision of time to innovate ideas and support their efforts has affected adoption of LCP*

Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

20. Transparency and efficiency in communication and planning by the management and stakeholder has affected adoption of LCP*

Mark only one.

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

Section 4: Financial Constraints

21. Financial constraint has affected adoption of LCP *

Mark only one.

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

22. Low tender price and insufficient budget has affected adoption of LCP*

Mark only one.

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

23. Expensive training cost and hiring consultant in construction site has affected adoption of LCP*

Mark only one.

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

24. Improvement of incentive for motivation in construction site has affected adoption of LCP*

Mark only one.

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

25. High turnover rate due to low wages of workers has affected adoption of LCP*

Mark only one

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

Section 5: Lack of Knowledge and technical skills.

26. Lack of knowledge and technical skill has affected adoption of LCP*

Mark only one

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

27. Misunderstanding about manufacturing Lean principles applied in construction has affected adoption of LCP*

Select only one.

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

28. Inadequate level of education and awareness has affected adoption of LCP *

Select only one

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

29. Unavailability of local training center such as LCP Institute has affected adoption of LCP *

Select only one

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

30. Skill of Prevention through Design (PtD) Techniques to prevent incident at design stage has affected adoption of LCP *

Mark only one

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

31. Skill of continuous improvement or KAIZEN Techniques to prevent incident has affected adoption of LCP *

Mark only one

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

32. Skill of Last Planner System (LPS) Techniques to prevent incident before commencing work has affected adoption of LCP *

Mark only one

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

33. Lack of professional on job guidance to provide the experiences has affected adoption of LCP*.

Mark only one

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

Section 6: Lack of Government Support

34. Lack of government support has affected adoption of LCP *

Mark only one.

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

35. Inconsistent policy of government has affected adoption of LCP *

Mark only one.

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

36. Economic and inflation has affected adoption of LCP *

Mark only one

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

37. Lack of government's promotion or incentive to the G7 company which practice LCP has affected adoption of LCP *

Mark only one

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

38. LCP at your workplace is/was affected by unavailability of local training center which lack of collaboration with government agencies such as NIOSH, DoSH, JKR and CIDB. *

Mark only one

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

Section 7: Human Attitudinal Problems

39. Bad human attitudinal in LCP has affected adoption of LCP *

Mark only one

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

40. Poor leadership which is lead to employee resistance to implement has affected adoption of LCP *

Mark only one.

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

41. Misunderstanding and doubt of unfamiliar practices by workers has affected adoption of LCP *

Mark only one.

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

42. Effort to undergo brainstorming or lesson learn session during process flow has affected adoption of LCP *

Mark only one

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

43. Integrity and anti-bribery policy of your workers has affected adoption of LCP *

Mark only one

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

44. Selfishness of professional to provide the experiences has affected adoption of LCP. *

Mark only one

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

Section 8: Safety Improvement

45. The LCP has improved safety in yourorganization*

Mark only one

- ☐ Yes
- ☐ No

46. The barriers in adopting LCP have affected the safety Improvement in your organization

Mark only one

- ☐ Yes
- ☐ No

47. Management and government promotion in adopting LCP has affected the Organizational safety Improvement of your organization.

Mark only one

- ☐ Yes
- ☐ No

48. Has imposition of LCP in the workplace have been beneficial to safety Improvement in your organization? *

Mark only one

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

49. Do you think the LCP of Prevention through Design (PtD) can prevent incident and improve safety at your workplace? *

Mark only one

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

50. Do you think the LCP of Last Planner System (LPS) can prevent incident and improve safety at your workplace? *

Mark only one.

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

51. Do you think the LCP of visualization through warning signages can prevent incident and improve safety at your workplace? *

Mark only one

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

52. Do you think the LCP of 5S through housekeeping can prevent incident and improve safety at your workplace? *

Mark only one

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

Section 9: Opinions and Conclusion

53. There are new strategies for the construction industry as a result of the impact of barriers in LCP to improve safety which are *

Mark all that apply.

- [ ] Increased use of technology/digitalization in process flow from design stage.
- [ ] Stabilizing process flow and supply chain by minimizing wastage start from design stage till final process flow.
- [ ] Innovation ideas in construction operation and construction cost via Engineering Value.
- [ ] Increase awareness towards LCP to improve safety, health and welfare of employees among the team including designer, consultant, client, main contractor, subcontractor and stake holders.
- [ ] Tighten safety risk control management by government through implementation of LCP.
- [ ] Other: _____

54. How do you think the Government could assist in reducing the barrier of LCP to improve safety of the G7 Contractors in Selangor and Kuala Lumpur? *

Mark all that apply.

- [ ] Incentives stimulus package to G7 contractors
- [ ] Prioritized mega project award to G7 contractors.
- [ ] Provide financial aids such as income tax relief/tax, incentive/ discount Stamp Duties to G7 contractors.
- [ ] Enforcement of compulsory compliance by G7 contractors and stakeholder with the Guideline OSHCIM: Occupational Safety and Health in Construction Industry (Management).
- [ ] Continuous promotion of safety through LCP by all type of contractor and project team including designer and owner of the project.
- [ ] Other: _____

APPENDIX B

APPROVAL PAGE

TITLE OF PROJECT PAPER: **THE BARRIERS IN ADOPTING LEAN CONSTRUCTION PRINCIPLE (LCP) IN SELANGOR AND KUALA LUMPUR.**

NAME OF AUTHOR : SITI ROSNAH BINTI SALMAN

The undersigned certify that the above candidate has fulfilled the condition of the project paper prepared in partial for the degree of Master of Business Administration.

SUPERVISOR

Signature : _____

Name :

Date :

ENDORSED BY:

_____

Dean

Graduate School of Business

Date: