

# Project Management Practices to Empower Lean Construction in Malaysia's Construction Industry

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**Abstract:** Construction industry is often viewed as problematic and inefficient. Lean Construction (LC) is one of practice to solve project management practice. Nevertheless, previous studies have found that Malaysia's LC issues are a lack of management commitment, limited awareness of the concept, and a culture of resistance to change. Therefore, the objectives of this research are to identify the main problems of LC practices in construction project management and to identify the main solutions to empower LC practices in construction project management. This research focused on construction company G7 in Pahang as respondent and used a quantitative method to achieve all of objectives. This study surveys the 118 perceptions of Grade 7 contractors in Pahang. The respondents were given a questionnaire by face-to-face meeting and in a link of google form through WhatsApp and Email. A total of 81 (69%) respondents have given feedback in the questionnaire. Descriptive statistic by SPSS software was used to analyse the data for all objectives. This research found that the main problems and main solutions respectively insufficient training for workers and an internal management sponsor recorded as the highest frequency. This study may help G7 contractors adopt LC practises to successfully complete construction projects and advance the Malaysian construction industry.

**Keywords:** Contractor, Lean Construction, Practice, Project Management

## 1. Introduction

The construction industry is frequently characterised as one that is plagued by problems and inefficient in its operations. The application of the Lean Construction (LC) concept, it is claimed, will

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provide a solution to all of these issues. Nowadays, this industry's growth is accelerated by improvements in quality of life, construction of new infrastructure, shifts in consumption patterns, and an expanding population (Kupusamy *et al.*, 2019). Unfortunately, the construction industry is plagued by a slew of problems, particularly in the area of construction waste, that must be addressed (Ding *et al.*, 2020).

The term Lean Construction (LC) was coined by Lauri Koskela in 1992 on the basis that, in order to improve the quality and efficiency of construction processes, construction materials, labour, and manpower will need to be utilised to the greatest extent possible with a view to eliminating waste and any non-value adding activity while delivering value to the client (Koskela, 1992). The goal of LC is to make the customer happy by designing both the built facilities and the construction process that makes them happen at the same time, and then controlling each step of the process (Mao & Zhang, 2008). LC is the most effective and widely applicable technology in the construction industry for improving quality, safety, and productivity (Franz, 2018). As a part of Malaysia's construction industry, the CIDB, a governmental agency, does not use a LC approach to reduce construction waste in its projects. The implementation of this strategy is the result of the organisations in the construction industry taking the initiative. Regarding to Ahmed & Wong (2018), LC can be implemented successfully within construction firms by instilling a new corporate culture and providing employees with the necessary education and training

A lack of lean awareness and understanding, culture and human attitudes, a lack of top management commitment, as well as a lack of time and commercial pressure are the main challenges (Sarhan & Fox, 2013). The solutions to empower LC practices in Malaysia's construction project management are still not effective to solve main issues (Ansah *et al.*, 2016). The relationship barriers with empower LC in Malaysian construction companies shows that a lack of management commitment, limited awareness of the concept of lean construction, a reluctance to adopt new concepts and a culture of resistance to change are not related each other's but some main problems is related (Marhani *et al.*, 2021). As a conclusion, based on Sarhan & Fox (2013); Bashir *et al.* (2015), Ansah *et al.* (2016) & Marhani *et al.* (2021) shows that there are issues in LC practices in construction project management. Therefore, this research will implement perhaps to discovers all the issues. There are two research objectives that can be concluded to gain a legit data. Those research objectives are including to identify the main problems of Lean Construction (LC) practices in construction project management and to identify the main solutions to empower LC practices in construction project management.

The research area is located in Pahang. This research emphasised the level of project management among selected Construction Company G7 in Pahang. The State of Pahang has launched the State Structure Plan (RSN) is a written statement that formulates the general policy and proposal of land in a state that covers the social, economic, physical and environmental aspects of the Local Planning Authority (PBPT) area as under the provisions Section 7 to Subsection 11B, Town and Country Planning Act 1976, (Act 172) (Pahang, 2022). This shows that Pahang is a state that already has a thorough preparation and planning to further develop Pahang in terms of infrastructure. The research explained the relationship between LC awareness and appropriate solutions to empower LC in Malaysian construction industry.

This research emphasised the level of project management among selected construction company G7 in Pahang. The Construction Industrial Development Board (CIDB) has made it mandatory for all Grade G7 contractors to be certified to the ISO 9000 Quality Management System. Failure to do so will result in the company ratings being downgraded, which will have an effect on their business operations (Marhani *et al.*, 2012).

The research is necessary to determine the project management practices to empower LC in Malaysia's construction industry. This study is significant to the following parties as follows. For top management, this research could be beneficial to top managers in construction companies to

continuously improve the performance of their company and be able to maintain the good name of their company if they practice this LC practice because of its many benefits. Secondly, to the contractor it could help contractors working on the site be more alert when it comes to construction waste management of the construction project. Therefore, this will be able to avoid wastage and in turn be able to increase profits. Besides that, to the labour it could be helpful for labour to always keep awareness about maintaining the smooth running of a project. If construction workers are able to follow and practice this LC practice, then it will make them a quality worker and to the students and educators it could be a reference to be used in the future. The research may gain new knowledge and understanding of the project management practices to empower LC in Malaysia's construction industry.

## 2. Literature Review

### 2.1 The problems of LC practices in construction project management

A significant number of studies have been carried out in a variety of countries on the difficulties that must be overcome in order to implement LC in the construction industry. The list includes developed countries, developing countries, and under developed countries from all over the world. Based on Sarhan & Fox (2013), in the construction industry of the United Kingdom. They discovered that the primary challenges are, in descending order of severity, a lack of adequate lean awareness and understanding, and time and commercial pressure. Other than that, these are barriers to adopting LC. There are other obstacles to implementing LC techniques. The following are the 15 problems that have been discovered around the world:

#### *(a) Management resistance to change*

Learning or adopting lean tools is not enough, it also requires a shift in people's mindsets, as well as a shift in business practices (Keiser, 2012; Gao & Low, 2014). Especially in the construction industry, where a resistance to change is one of the industry's most well-known characteristics, this is a challenge (Sarhan & Fox, 2013), most companies prefer to stick to traditional ways of management (Raghavan *et al.*, 2014) and rejection of the new ideas from other sectors, including manufacturing, is very frequent (Sarhan & Fox, 2013). As a result, resistance to change was thought to be one of the most significant barriers to the implementation of lean (Sarhan & Fox, 2013).

#### *(b) Lack of customer focus and a lack of understanding of customer needs*

Lean thinking emphasises the importance of customer value (Ogunbiyi *et al.*, 2014). In order to avoid defects during the lean transformation, the philosophy of lean should be viewed as one that is centred on the values and needs of the customer (Herrala *et al.*, 2012). Many construction companies lack the proper tools to identify and assess the needs of their customers (Khaba & Bhar, 2017), despite the importance of focusing on the customer, satisfying them, and understanding their needs in order to achieve differentiation (Herrala *et al.*, 2012) and profitability (Gao & Low, 2014).

#### *(c) Lack of lean awareness and comprehension*

When a new concept is introduced, it isn't always because people are resistant to change, but rather because they don't understand it. Even though the concept of LC is relatively new (Gao & Low, 2014), therefore, finding low levels of exposure to, awareness and understanding of it is not surprising in developing and developed countries (Ayalew *et al.*, 2016; Kanafani, 2015; Small *et al.*, 2017; Raghavan *et al.*, 2014; Abdullah *et al.*, 2009).

#### *(d) Lack of planning for quality*

It is more difficult to complete a successful project when quality is neglected during the planning stage. To ensure that the project is deemed a success, the project manager determines the criteria that

must be met before any work can begin. Quality planning should be included in the planning process because it is linked to customer satisfaction (Taj, 2005; Shah & Ward, 2003). More non-value-adding activities are a result of inadequate quality planning (Khaba & Bhar, 2017).

*(e) Lean possibly leading to additional cost/implementation cost*

When embarking on a lean journey, time and money play a significant role. Adopting a new philosophy is influenced by market conditions, financial crises, inflation, and the lack of adequate resources and funding (Marhani *et al.*, 2012; Sarhan & Fox, 2013; Alvarenga *et al.*, 2017). Aside from training workers and hiring consultants, rewarding employees and professionals, purchasing necessary equipment for some lean tools requires sufficient financial resources (Bashir *et al.*, 2015).

*(f) Poor leadership and insufficient management skills*

Management and leadership deficiencies have a negative impact on a company's willingness to change (Cano *et al.*, 2015; Gao & Low, 2014). Starting and sustaining a lean journey necessitates effective leaders and a continuous improvement culture, according to Aziz & Hafez (2013). In addition, identifies growing leaders who understand the work, live the culture, and teach others as a principle of the people/partner in the 4P model. To be an effective leader, it must inspire others to get involved at work and change their behaviour, maintain a culture of change, spread positivity, and raise enthusiasm for continuous improvement among those around you (Hamzeh *et al.*, 2016).

*(g) Lack of incentives and motivation and poor professional wages*

LC core concept of business re-engineering, according to Alinaitwe (2009), is hampered by a shortage of highly motivated professionals. Aziz & Hafez (2013) found that in every company, there are three types of employees, with the first group being those who work hard and actively to improve their work. Workers of the second type are enthusiastic about finding new ways to improve their jobs, but they do so without taking any concrete steps or making any efforts. The third type of people are those who have no interest in improving the work. The first type of people is known as champions, and they make up a small percentage of each company. In lean implementation, these champions play an important role; they are the driving force behind many successful lean experiences (Hamzeh *et al.*, 2016). Chances for lean transformation decrease if champions are demotivated or leave the company. Insufficient training for workers.

*(h) Lack of integrated procurements*

More collaborative procurement methods and contracts should also be used in order to improve the application of LC principles and to increase cooperation between different parties (Common *et al.*, 2000). Because they separate the design and construction phases of a project (Johansen & Walter, 2007), Design-Bid-Build contracts, in particular, make it more difficult for different stakeholders to work together and integrate their efforts, and they also make it more difficult for new construction techniques to be applied (Dulaimi & Tanamas, 2001). In addition, these contracts can lead to conflict between the project participants because they impose the authority of the contractor (Forgues & Koskela, 2009; Sarhan & Fox, 2013).

*(i) Unskilled labour and the low level of education of the site employee*

Because of the defects and rework they cause and the money they cost, workers' incompetence is a major source of waste in construction projects (Al-Aomar, 2012; Al-Rifai & Amoudi, 2016). The low levels of literacy and education among employees make it difficult for management to rely on them during the implementation of LC, particularly the most recent planner systems (Sweis *et al.*, 2016). Worker inability to read drawings and report completed and upcoming work is a common problem in construction. Managers and supervisors must be on hand to provide guidance in these situations (Mossman, 2009).

*(j) High turnover of workforce*

Since high turnover rates are common in construction, management's willingness to provide adequate training decreases, which has a significant impact on the design and allocation of workloads (Gao & Low, 2014).

*(k) Stringent requirements and approvals during contracting*

The complexity of the contracting process is another factor that is related to contracting. There are numerous obstacles to implementing LC, including lengthy client approvals, bureaucracy in governmental organisations, and policy inconsistencies, all of which are viewed as wastes and impediments (AlSehaimi *et al.*, 2014; Gao & Low, 2014; Khaba & Bhar, 2017).

*(m) Insufficient information administration to create a learning cycle and take corrective action*

It's important to remember that one of the obstacles to the 4 P model's problem solving is the inability to effectively manage the enormous amounts of data generated and the lack of lessons learned that can be applied in subsequent endeavours (Khaba & Bhar, 2017).

*(n) Lack of identification and control of waste*

There is another barrier to waste elimination in the process, which is a lack of waste identification and control, in the 4 P model (Cano *et al.*, 2015). Locating inefficiencies and their root causes is critical for improving decentralisation, as is generating data and identifying wastes to aid in the management of processes (Viana *et al.*, 2012).

*(o) Lack of a long-term philosophy and planning*

Lean requires a long-term strategy and philosophy. Liker's 4P model created a long-term strategy. To reach the top of the TPS pyramid, continuous improvement and learning, the company must go through three levels: building a long-term philosophy, focusing on waste elimination, and respecting people and partnering. Long-term philosophy means making decisions based on long-term vision, even if short-term financial goals are sacrificed (Liker, 2004). Lack of long-term philosophy and planning prevents companies from focusing on customer value (Meiling *et al.*, 2012) and reduces top management support and commitment (Bashir *et al.*, 2015).

## 2.2 The solutions to empower LC practices in construction project management

A great number of LC central ideas are ones that can be put into practise by various stakeholders. In order to empower LC practises, there are a few different solutions that the construction company can put into practice.

*(a) An internal sponsor at the highest management level*

It is essential to be able to count on a sponsor at the highest hierarchical level within the company who not only supports the implementation but also actively participates in it, who also leads it and allocates the necessary resources (Rother, 2009). Managers at all levels use these tools to keep track of and improve their own performance and the performance of others (Alireza & Sorooshian, 2014). Other than that, they may use of the last planner technique. Last planners are people or groups of people who are responsible for ensuring that the production unit is running smoothly at all times.

*(b) The leadership provided from within the company by its middle managers*

It is necessary to identify intermediate leadership, who will be largely responsible for the maintenance of discipline in the application of the Lean management model, and who will help to generate conviction among the different hierarchical levels of the organization (Rother, 2009). The construction company may practice LC tools which is suggestion schemes. It's a formal mechanism that

encourages and supports employees to actively contribute productive ideas for product and process improvements (Alireza & Sorooshian, 2014).

*(c) Training at all hierarchical levels to empower workers*

It is necessary to develop and clearly define the necessary competencies and capacities that each role needs to have, in addition to developing a training plan for each hierarchical or functional level that exists within the organization (Rother, 2009). Using LC tools, such as work structuring, may be an option for the construction company. Designing processes and operations in accordance with supply chain structure, resource allocation and product design efforts in order to improve work process reliability and speed while still delivering quality to the customer, this is used (Tsao *et al.*, 2004).

*(d) Incorporate a system and a way of working that goes beyond the tools*

It is essential that we define the history of change that will serve as the driving force behind the transformation that will take place within the company. A vision that is clear, concise, and inspiring must be outlined so that it can be explained in just a few words. This vision must include the goals and objectives that we want to achieve as a result of the implementation, as well as the requirements that compelled us to undertake the Lean initiative (Pons & Rubio, 2019). There are many LC tools to empower LC practices such as six sigma. Tools and methods for enhancing product quality by locating and removing flaws and reducing process variability. Six Sigma can achieve 99.9966 % defect-free process quality (Alireza & Sorooshian, 2014). Next is Pareto Analysis. This is a bar graph that is used for analysing data about the frequency of the causes or problems in processes. It visually depicts which situation are more important.

*(e) Keep in mind that putting in place lean practice will take time*

Although there are aware that the optimum circumstances will almost certainly not be present, this should not serve as an excuse for delaying the launch of a Lean initiative. Therefore, each party must play a role to ensure the success of this initiative (Pons & Rubio, 2019). The construction company may practice LC tools which is continuous flow. In other words, it means to provide or process and produce on a continuous basis through a series of sequential steps (Aziz & Hafez, 2013; Alireza & Sorooshian, 2014). Next is, Bottleneck Analysis. By identifying the process component that is limiting overall productivity, it is possible to enhance that component's efficiency. SMART Goals also is one of LC tools. It is measurable and time-bound objectives that are based on facts rather than assumptions (Lean production, 2011).

*(f) Make an attempt, and if it doesn't work, fix it and try it again*

Should be aware that the first attempt at putting many of the lean methodologies that we plan to implement into practises will not be successful. If the initial effort is unsuccessful or does not make as much headway as we had hoped, we have no choice but to reflect on what went wrong and try again while keeping the lessons we've picked up in mind initiative (Pons & Rubio, 2019). Check Sheet is one of the LC tools that are suitable for this approach. The diagram is also known as a Defect Concentration Map. This is a pre-made, well-structured data collection form. For a variety of purposes, it can be used to observe and collect data on the frequency of problems, events, defects, and causes (Muhammad *et al.*, 2013).

*(g) A pilot project can be implemented with the help of an expert*

The definition of a project or pilot area whose lessons learned will serve to obtain first results on the state of maturity of the implementation is a strategy that is recommended for beginning a Lean implementation. Although the benefits achieved more often than not justify the investment, the primary goal of the pilot project is to gain learning rather than necessarily reaping benefits from its completion (Pons & Rubio, 2019). The construction company may practice LC tools which is 5 WHY tool. This is

a tool for problem-solving that is used in quality management, and it attempts to discover the underlying cause of an issue. It stipulates that worker should ask why five times repeatedly until they identify the underlying root or determine the nature of the problem and its solution becomes clear. This should continue until the problem is resolved. The process seeks to correct a problem by removing the fundamental reason for it in order to prevent its reoccurrence (Tsao *et al.*, 2004; Muhammad *et al.*, 2013).

*(h) An emphasis on the flow of value*

In order to put its core principles and guiding philosophy into action, lean thinking makes use of a wide variety of tools and approaches. The following are examples of some of the tools that have proven to be particularly useful in the process of putting LC into practise: A number of methodologies, including Value Stream Mapping, the 5S Methodology, Takt Time Planning, the Last Planner System, the A3 Report from Toyota, Standardization, Visual Management, and Hoshin Kanri, have been utilised in the manufacturing industry (Pons & Rubio, 2019). The construction company may practice LC tools which is practice Daily Huddle Meetings. This is a method for getting the project team's employees involved in the communication and day-to-day meeting process. Project awareness and problem-solving contribution along with training provided by various tools will increase job satisfaction (Muhammad *et al.*, 2013; Salem *et al.*, 2005).

*(i) Maintaining and integrating the entire value chain is essential to success*

In the years to come, effective management of knowledge within companies will be an essential component. And unless want to remain permanently embroiled in a price war and continually navigate in red oceans, it will need to invest in both knowledge and technologies, in addition to providing its customers with solutions that have a high value-added component for them (Pons, 2014). This is LC tools or techniques that suitable for this action which is PDCA (Plan, Do, Check, Act). This is an iterative approach to the implementation of improvements. It entails four steps: plan (create a strategy and set goals), do (put the strategy into action), check (confirm the results expected), and take action (evaluate; do it again) (Lean production, 2011) and Team Preparation. This technique reduces production flow and supplier and end-user response times. JIT is a way of thinking, working, and managing to reduce waste (Alireza & Sorooshian, 2014).

*(j) Make use of the appropriate tools*

Technology is seen as the solution to almost all of people's problems, and many people see it as their saviour. People who aren't familiar with the Lean culture frequently have the misconception that putting in place tools like the Last Planner System entails putting in place planning software. In this sense, the best way to learn from others and set a good example to follow in Lean implementation projects is to follow the principles of the Toyota production system. The recommendation is to initiate the use of particular software and technologies once the work team has confidence in the system and they are fully aware of the benefits of lean manufacturing. In any case, the introduction of new software and technologies should not make processes and daily routines more complicated but rather simpler, more efficient, and less time consuming (Pons, 2014; Alireza & Sorooshian, 2014).

### **3. Research Methodology**

The research methodology section describes all the necessary information that is required to obtain the results of the study. The research methodology consists of detailed information regarding workflow, strategy, and approach. The methodology adopted in carrying out the study should be well explained.

#### **3.1 Research Design**

*(a) Procedure of Research*

The procedure of research that applies to conduct this research as shown in Appendix A. There are 5 phase that conduct in this research. All of the phase generally represents overall process in the research.

*(b) Research Method*

This research uses quantitative method to achieves all of objectives. Quantitative as a research method that explain its findings in numbering form. Quantitative research is executed through designation of questions and surveys relevant to the set objectives of study in a form of structured questions.

*(c) Respondent*

This research used Table of Krejcie & Morgan (1970) in determining the sample size. In addition, the population in this research is the contractors who registered in Grade 7 as well as the population size, is estimated at around 170 respondents in Pahang (CIDB, 2021). Therefore, the sample size is around 118 (Refer to Appendix B).

*(d) Research Instrument*

The questionnaire was primarily used to evaluate the agree level of contractors to the impact of the main problems of Lean Construction (LC) practices in construction project management, the main solutions to empower LC practices in construction project management as well as the relationship between the main problems with main solutions to empower LC practices in construction project management. Likert five-point scales are used as contexts for questions, varying from strongly agree to strongly disagree. There are 3 sections which include Section A, Section B, Section C and Section D. Section A is regarding background of the respondents. Section B is about the problems of LC practices in construction project management. Section C is regarding the solutions to empower LC practices in construction project management.

3.2 Pilot Study

The researcher had conducted a pilot study before performing the full study and distributing an online questionnaire to the respondents. In the pilot study, a total of 8 respondents in Pahang have answered the online questionnaire provided. According to Bullen (2021), after the survey questionnaire design is completed, 5 to 10 respondents from the target population are selected.

*(a) Reliability Analysis*

Cronbach's alpha was used to determine the reliability of multiple-question Likert scale surveys. These questions assess latent variables, which are hidden or unobservable such as a person's conscientiousness, neurosis, or openness (Glen, 2021). The following rule of thumb: “ $\alpha > 0.9$  – Excellent,  $\alpha > 0.8$  – Good,  $\alpha > 0.7$  – Acceptable,  $\alpha > 0.6$  – Questionable,  $\alpha > 0.5$  – Poor, and  $\alpha < 0.5$  – Unacceptable”. According to the results of the reliability analysis on the data gathered, the Cronbach's Alpha is 0.952, as shown in Table 1, indicating that the questionnaire is reliable and the items have reasonably high internal consistency.

**Table 1: Reliability Test**

Number of Questions	Number of Respondents	Alpha Cronbach's Value
78	8	0.952

3.3 Data Collection

The data was collected and gathered by way of an online questionnaire distributed among 118 of Grade 7 contractor companies in Pahang. The questionnaire was designed by manual form set (face to face meeting) and online by using the google form. The link of google form shared on the platform such as WhatsApp and Email.



### 3.4 Data Analysis

The collected data was analysed using Statistical Package for Social Sciences (SPSS) software. In this study, frequency analysis was used to explain the basic features of the data. A simple descriptive analysis using of mean technique was applied and the crosstab analysis was used to do a relationship analysis. The researcher used frequency to analyse the data in Sections A (background of the respondents), B (problems of LC practices in construction project management), and C (solutions to empower LC practices in construction project management). In this study, the researcher used the same Likert Scale in Sections B and C. These sections used the 5-point Likert Scale to evaluate the agreement level of the Grade 7 contractors. The researcher derived the results as well as the average response (mean) from the 5-point Likert scale.

## 4. Results and Discussion

The results and discussion section presents data and analysis of the study. This section can be organized based on the stated objectives, the chronological timeline, different case groupings, different experimental configurations, or any logical order as deemed appropriate.

### (a) Section A: The Background of Respondents

The section describes the sample characteristics of the typical respondents and encloses the general pattern of the responses. Besides, the table of summary of the data analysis in Section A had shown in Table 2. The percentage of the male respondent is higher than female respondents with a total percentage of 79% with a total of 64 respondents. The percentage for age for between 30 to 40 years old is the highest, with 74.1% equal to 60 respondents. Furthermore, the highest qualifications for degree are the highest, with 54.3% and 44 respondents. Next, the highest percentage for years of service in the construction industry is between 11 to 20 years with 49.4% and a total of 40 respondents. The percentage for job title for site supervisor is the highest, with 43.2% equal to 35 respondents.

**Table 2: Summary of Data Analysis in Section A**

No.	Background of Respondents	Frequencies	Percent (%)
1	Gender		
	Male	64	79
	Female	17	21
2	Age		
	Between 18 to 29 years old	12	14.8
	Between 30 to 49 years old	60	74.1
	Between 50 to 59 years old	9	11.1
	60 years old and above	0	0
3	Highest Qualifications		
	Primary/ Secondary	0	0
	Diploma	34	42
	Degree	44	54.3
	Masters/ Ph.D.	3	3.7
4	Years of service in the construction industry	7	8.6
	Between 1 to 5 years	28	34.6
	Between 6 to 10 years	40	49.4
	Between 11 to 20 years	6	7.4
	21 years and above		

5	Job Title		
	Project Manager	33	40.7
	Safety Officer	3	3.7
	Site Supervisor	35	43.2
	Civil Engineer	2	2.5
	Quantity Surveyor	6	7.4
	Architect	2	2.5

(b) Section B: Problems of LC Practices in Construction Project Management

Based on Table 3, the mean average score is categorized and interpreted into three levels. A mean score of 1.00 to 2.33 refers to a low mean value, a score of 2.34 to 3.66 is a mean value at a moderate level and a mean score of 3.67 to 5.00 indicates a mean value at a high level.

**Table 3: Assessment Level Based on Mean Score (Ibrahim, 2013)**

Mean Score Range	Score Level	Mean
1.00-2.33	Low	(Not Agree/ Not Helpful/ Unsatisfied/ None/ Sometimes/ Not Sure)
2.34-3.66	Moderate	(Agree/ Helpful/ Satisfied)
3.67-5.00	High	(Strongly Agree/ Fully Satisfied/ Really Helpful)

Based on Table 4, the majority of respondents achieved high agreement level (refer Table 3) that the problems of LC practices in construction project management is insufficient training for workers with the highest mean value, 4.0555. Next, followed by high turnover of workforce, poor leadership and unskilled labour which the mean value is 3.9876, 3.8601 and 3.7037 respectively. Furthermore, some of respondents strongly agreed (high of agreement level) that the problems are lack control of waste with a mean value of 3.6870. According to the data analysis of the returned questionnaires, the respondents achieved moderate agreement level that lack of planning for quality (3.6214) is one of the problems. Based on the data analysis of the questionnaires returned from respondents, the respondents agreed (moderate of agreement level) that the problems of LC practices in construction project management is lack of integrated procurements (3.6091), lack of incentives (3.5761) and insufficient information administration (3.5144). According to the feedback given by the respondents, they also chose to be agreed (moderate of agreement level) that lack of lean awareness (3.4938), lean possibly leading to implementation cost (3.4815), lack of customer focus needs (3.3868), lack of a long-term planning (3.3745), stringent requirements during contracting (3.3662) and management resistance to change (2.9341) is the problems of LC practices in construction project management.

**Table 4: Mean Analysis of Problems of LC Practices in Construction Project Management**

No.	Problems	Mean	Agreement Level	Ranking
	Management resistance to change	2.9341	Moderate	15
1.	Prefer to stick to traditional ways.	3.2469	Moderate	1
2.	Rejection of the new ideas from other sectors.	2.6296	Moderate	3
3.	No desire to improve	2.9259	Moderate	2
	Lack of customer focus needs	3.3868	Moderate	12
4.	Lack of the proper tools.	3.7284	High	1
5.	Miscommunication.	3.3704	Moderate	2

6. Lack of talented management.	3.0617	Moderate	3
Lack of lean awareness	3.4938	Moderate	10
7. Do not understand what it is Lean Construction	3.6173	Moderate	2
8. Hard to get the required information.	2.7778	Moderate	3
9. Lack of campaign.	4.0864	High	1
Lack of planning for quality	3.6214	Moderate	6
10. Too many nonvalue-adding activities.	4.0864	High	1
11. No commitment.	3.3457	Moderate	3
12. Poor proper planning.	3.4321	Moderate	2
Lean possibly leading to implementation cost	3.4815	Moderate	11
13. Fear of more losses.	4.0988	High	1
14. Cost operation increase.	3.8148	High	2
15. Companies made no profit.	2.5309	Moderate	3
Poor leadership	3.8601	High	3
16. Spreading negative practices.	4.0123	High	1
17. Incontiguous improvement.	3.8395	High	2
18. Low commitment.	3.7284	High	3
Lack of incentives	3.5761	Moderate	8
19. Not appreciating employees.	3.4938	Moderate	3
20. Company profits take precedence.	3.5556	Moderate	2
21. Availability of incentives is low.	3.6790	High	1
Insufficient training for workers	4.0555	High	1
22. Reduces output.	4.1235	High	1
23. The lower level of performance.	4.0370	High	3
24. Quality problems.	4.0864	High	2
25. Wasted time result.	3.9753	High	4
Lack of integrated procurements	3.6091	Moderate	7
26. New construction techniques harder to apply.	3.8642	High	1
27. Make stakeholder collaboration harder.	3.1852	Moderate	3
28. Causes project conflict.	3.7778	High	2
Unskilled labour	3.7037	High	4
29. It is hard to teach something.	3.9259	High	1
30. Hard to rely on during LC implementation.	3.5926	Moderate	2
31. Difficult to communicate.	3.5926	Moderate	2
High turnover of workforce	3.9876	High	2
32. Results of low-quality work.	4.0370	High	1
33. Demotivation.	3.9506	High	3
34. Adequate training decreases.	3.9753	High	2
Stringent requirements during contracting	3.3662	Moderate	14
35. Lengthy client approvals.	3.4691	Moderate	1
36. Bureaucracy in governmental organisations.	3.3086	Moderate	3

37. Policy inconsistencies.	3.3210	Moderate	2
Insufficient information administration	3.5144	Moderate	9
38. Inability to manage big data.	3.6296	Moderate	1
39. Unapplicable lessons.	3.4074	Moderate	3
40. No sense of wanting to change.	3.5062	Moderate	2
Lack control of waste	3.6870	High	5
41. Lack of inspection processes.	3.8519	High	1
42. High operation management cost.	3.5062	Moderate	3
43. Lack of inspection technology	3.7037	High	2
Lack of a long-term planning	3.3745	Moderate	13
44. Making short-term decisions only.	3.2963	Moderate	2
45. Weak management support.	3.2469	Moderate	3
46. Will distract from customer needs.	3.5802	Moderate	1

According to the analysis of the research, the problems of LC practices in construction project management is insufficient training for workers with the highest mean value, 4.0555. Therefore, the problems of LC practices in construction project management, namely insufficient training for workers had caused the problems of LC practices in construction project management. This is also acknowledged by Salem *et al.* (2005) where their study also stated that the insufficient training for workers are the problems to implement LC practices in construction project management. Meanwhile, the lowest mean of the problems of LC practices in construction project management is 2.9341, which is management resistance to change. This is because a majority of the respondents think that the management resistance to change does not influence to implement LC practices. Thus, with this the first objective which is to identify the main problems of LC practices in construction project management has been achieved.

*(c) Section C: Solutions to Empower LC Practices in Construction Project Management (Objective 2)*

Based on Table 5, the majority of respondents achieved high agreement level (refer Table 3) that solutions to empower LC practices in construction project management is an internal management sponsor with the highest mean value, 4.4732. Next, followed by the leadership provided, make use of the appropriate tools and training at all hierarchical levels to empower workers which the mean value is 4.4568, 4.4403 and 4.4321 that achieved high agreement level respectively. Furthermore, some of respondents strongly agreed (high of agreement level) that the solutions are incorporate a system with a mean value of 4.4280. According to the data analysis of the returned questionnaires, the respondents also strongly agreed (high of agreement level) that maintaining the entire value chain (4.4197) is one of the solutions. According to a study of the data from the questionnaires that were handed back by respondents, the respondents gave a resounding consensus (high of agreement level) that the solutions to empower LC practices in construction project management is implement pilot study with an expert (4.3992), make an attempt (4.3909), keep in mind that lean practice will take time (4.3745) and emphasis on the flow of value (4.3292).

**Table 5: Mean Analysis of Solutions to Empower LC Practices in Construction Project Management**

No.	Solutions	Mean	Agreement Level	Ranking
	An internal management sponsor	4.4732	High	1
1.	Provide incentives.	4.3333	High	3
2.	Provide enough facilities.	4.5185	High	2

3. Provide motivation.	4.5679	High	1
The leadership provided	4.4568	High	2
4. Identify intermediate good leadership.	4.4568	High	2
5. Expert in dealing with any problems.	4.4198	High	3
6. Be willing to succeed.	4.4938	High	1
Training at all hierarchical levels to empower workers	4.4321	High	4
7. Define each role's abilities.	4.3580	High	4
8. Define each role's skills.	4.4198	High	3
9. Invest more money for training.	4.4691	High	2
10. Establish planning clearly.	4.4815	High	1
Incorporate a system	4.4280	High	5
11. Outline a clear vision.	4.4074	High	2
12. Vision must include goals.	4.3457	High	3
13. Accept corrections to improve.	4.5309	High	1
Keep in mind that lean practice will take time	4.3745	High	9
14. Each party must play a role.	4.3457	High	2
15. Follow the vision and mission.	4.3457	High	2
16. Keep being positive.	4.4321	High	1
Make an attempt	4.3909	High	8
17. Always brainstorming with the team.	4.3580	High	3
18. Do not give up easily.	4.3951	High	2
19. Always review the mistakes made.	4.4198	High	1
Implement pilot study with an expert	4.3992	High	7
20. Always diligent to make changes.	4.3827	High	3
21. Plan properly.	4.4198	High	1
22. Keep trying to find new ideas.	4.3951	High	2
Emphasis on the flow of value	4.3292	High	10
23. Employee understands the concept.	4.2469	High	3
24. All employees know their jobs.	4.3827	High	1
25. Top management must care about workers.	4.3580	High	2
Maintaining the entire value chain	4.4197	High	6
26. Invest in technologies.	4.3457	High	4
27. Invest in knowledge.	4.3951	High	3
28. Top management needs to listen to all the views of all employees.	4.4938	High	1
29. Stay disciplined.	4.4444	High	2
Make use of the appropriate tools	4.4403	High	3
30. Understand all tools/techniques.	4.4198	High	2
31. Top management must know to use tools/techniques effectively.	4.3827	High	3
32. Not stingy to invest to try a tools/technique.	4.5185	High	1

The solutions to empower LC practices in construction project management is an internal

management sponsor with the highest mean value, 4.4732. Therefore, the solutions to empower LC practices in construction project management, namely an internal management sponsor could be the best solutions to solve the problems. This is also acknowledged by Khaba & Bhar (2017) where their study also stated that an internal management sponsor are the solutions to empower LC practices in construction project management. Meanwhile, the lowest mean is 4.3292, which is emphasis on the flow of value. This is because the majority of respondents believe that focusing on the flow of value is not the best way to empower LC practices. Thus, with this the second objective which is to identify the main solutions to empower LC practices in construction project management has been achieved.

## 5. Conclusion

The findings of this research have demonstrated that all of the objectives of this research have been successfully accomplished through the utilisation of the outcomes of the data analysis obtained from the questionnaires that have been returned. The accomplishment of the aims is critical to guaranteeing the success of the research. Based on the research that has been done, the researcher found that the main problems is 'Insufficient training for workers' and main solutions is 'An internal management sponsor' to empower LC practices in construction project management were agreed upon by the Grade 7 contractors that related to (Ayalew *et al.*, 2016; Kanafani, 2015; Small *et al.*, 2017; Raghavan *et al.*, 2014; Abdullah *et al.*, 2009). As a conclusion, from finding of this research, it is hoped that the parties involved and responsible for addressing the problems will do so by utilising the solutions given. The construction industry has the potential to enjoy increased levels of prosperity and success if it is conducted in this manner.

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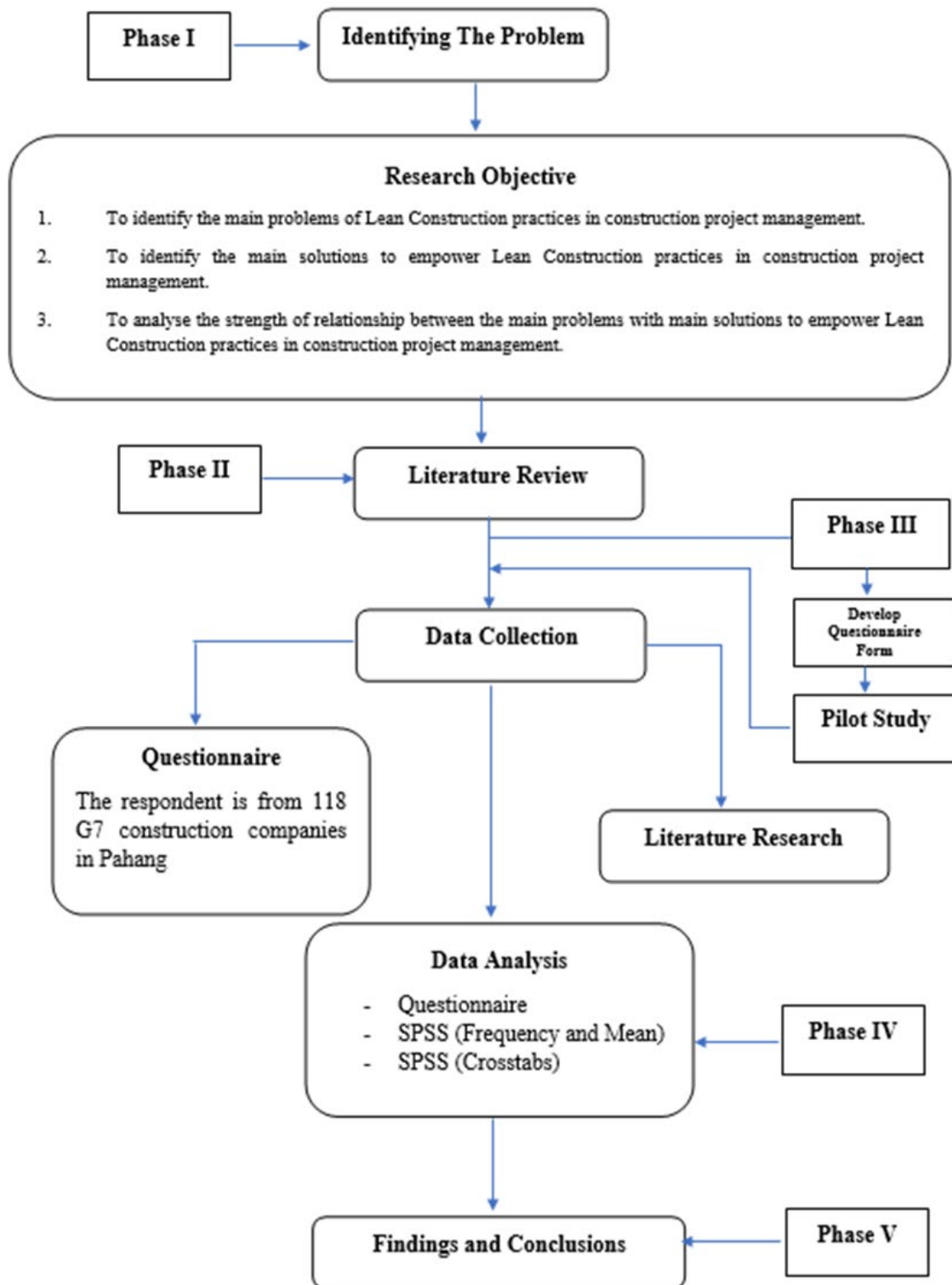


**Appendix A**

N	S	N	S	N	S	N	S	N	S
10	10	100	80	280	162	800	260	2800	338
15	14	110	86	290	165	850	265	3000	341
20	19	120	92	300	169	900	269	3500	346
25	24	130	97	320	175	950	274	4000	351
30	28	140	103	340	181	1000	278	4500	354
35	32	150	108	360	186	1100	285	5000	357
40	36	160	113	380	191	1200	291	6000	361
45	40	170	118	400	196	1300	297	7000	364
50	44	180	123	420	201	1400	302	8000	367
55	48	190	127	440	205	1500	306	9000	368
60	52	200	132	460	210	1600	310	10000	370
65	56	210	136	480	214	1700	313	15000	375
70	59	220	140	500	217	1800	317	20000	377
75	63	230	144	550	226	1900	320	30000	379
80	66	240	148	600	234	2000	322	40000	380
85	70	250	152	650	242	2200	327	50000	381
90	73	260	155	700	248	2400	331	75000	382
95	76	270	159	750	254	2600	335	1000000	384

Table Population (N) and sample (S) Krejcie and Morgan)

**Appendix B**



Procedure of Research