ANALYSIS ON SUCCESS FACTORS OF LEAN SIX SIGMA IMPLEMENTATION IN SME AND IT'S RELEVANCIES IN ERA OF PANDEMIC COVID-19

This report is submitted in accordance with the University Teknikal Malaysia Melaka (UTeM) requirement for a Bachelor Degree of Manufacturing Engineering (Hons.)

by

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DECLARATION

I hereby, declared this report entitled "Analysis on Success Factors of Lean Six Sigma Implementation in SMEs And It's Relevancies In Era Of Pandemic Covid-19" is the result of my own research except as cited in references.

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APPROVAL

This report is submitted to the Faculty of Manufacturing Engineering of Universiti Teknikal Malaysia Melaka as a partial fulfilment of the requirement for Degree of Manufacturing Engineering (Hons). The member of the supervisory committee is as follow:

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ABSTRAK

Pada masa kini, Lean dan Six Sigma (LSS) telah menjadi strategi perniagaan yang amat berkesan Pelaksanaan LSS di PKS perlu dikaji lebih lanjut untuk mencari status relevan sama ada LSS masih sesuai untuk dilaksanakan atau tidak di SME dalam era Pandemik covid-19. Projek ini terdiri daripada tiga metodologi yang berbeza untuk mencapai setiap objektif yang telah ditetapkan. Laporan projek ini akan menerangkan dengan lebih lanjut tentang metodologi dari segi pengumpulan data, analisis data, dan keputusan akhir. Kajian. Penyelidikan ini bertujuan untuk menganalisis faktor kejayaan pelaksanaan Lean Six Sigma dalam Perusahaan Kecil dan Sederhana (PKS) dan perkaitannya dalam era pandemik Covid-19. Kajian penyelidikan ini mengandungi tiga objektif. Objektif pertama adalah untuk menjelaskan dan menyenaraikan faktor kejayaan pelaksanaan LSS di Perusahaan Kecil dan Sederhana (PKS) dengan membaca rujukan kajian lepas. Dapatan untuk objektif satu ialah 13 kelompok faktor kejayaan telah dipilih, dan selepas analisis mendalam, hanya empat faktor kejayaan daripada 13 dipilih untuk menjadi Faktor Kejayaan LSS yang paling biasa. Objektif kedua adalah untuk menganalisis sama ada amalan LSS masih relevan kepada PKS dalam penularan wabak Covid-19 sekarang. Status relevan diputuskan selepas analisis mendalam tentang halangan Covid-19 kepada PKS dan faktor kejayaan LSS menggunakan kaedah perbandingan. Bagi objektif dua, tiga daripada empat faktor kejayaan LSS yang paling biasa adalah tidak relevan untuk dilaksanakan di PKS semasa era pandemik Covid-19. Selepas status relevan setiap faktor kejayaan LSS yang paling biasa diputuskan, objektif ketiga adalah untuk membuat pengesyoran yang boleh dan tidak boleh dilakukan untuk faktor kejayaan yang paling biasa yang tidak relevan. Untuk pengesoran yang ‘boleh dilakukan’ terdapat 13 pengesyoran, dan untuk ‘tidak boleh dilakukan’ ada tujuh pengesyoran. Cadangan ini adalah untuk memberi sedikit idea kepada PKS tentang cara menghadapi halangan dalam membantu mencapai kejayaan dalam menggunakan LSS di PKS semasa pandemik Covid-19. Hasil akhir projek ini bermanfaat kerana ianya akan menjadi garis panduan kepada PKS untuk merancang dan mengurus strategi mereka.

ABSTRACT

Nowadays, Lean Six Sigma (LSS) have become a well-established business strategy. Due to the Pandemic covid-19, many obstacles and multiple pressures on the organization and SME industries to implement Lean Six Sigma (LSS). Therefore, the relevancies of implementation of LSS in SME need to study more to find the relevancies status of whether the LSS is still adequate to be implemented or not at SME in the era of Pandemic covid-19. This project is consisted of three different methodologies to achieve each objective that has been set for this project. This project report explains more about the methodology in terms of data collection, data analysis, and the final results. This project aims to analyze the success factors of Lean Six Sigma implementation in SME and its relevancies in the era of pandemic Covid-19. This project consists of three objectives. The first objective is to clarify the success factors of LSS implementation in Small and Medium Enterprises (SMEs) through the literature study. The finding for objective one is that 13 clusters of success factors have been selected, and after a deep analysis, only four success factors out of 13 are chosen to be the most common LSS Success Factors. The second objective is to analyze whether the LSS practice is still relevant to the SME in the current pandemic of Covid-19. The relevancies status is decided after a deep analysis of the obstacles in Covid-19 to SME and the LSS success factors using the comparison method. For objective two, three out of four most common LSS success factors are irrelevant to implementation in SMEs during the era of pandemic Covid 19. After the relevancies status of each of the most common LSS success factors has been decided, the third objective is to make recommendations do(s) and don(s) for the irrelevant most common success factors. For the do(s), there are 13 recommendations and seven for don(s). This recommendation is to give some idea for SMEs on how to encounter the obstacles in the way to help achieve success in implanting LSS at SME during the pandemic Covid-19. This project output is beneficial because the output of these projects will be the guidelines for SME to plan and manage their strategy.

DEDICATION

Special dedication to my parents, Mr. Lujah Surat and Mrs. Merta Anak Rengkang, for their moral support and understanding of me throughout the semester in completing this project. I want to thank my siblings, friends, and lecturers for being there during my up and down. Thank You So Much and Love You All Forever.

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CHAPTER 1

INTRODUCTION

In this section, a few matters will be discussed, and these matters are divided into four subtopics. Those four subtopics are the background of the study, problem statement, objective, scope of the project, the significance of the study, and organization of the report.

1.1 Background of study

Nowadays, Lean and Six Sigma have become a well-established business strategy and one of the most well-known and widely accepted management Continuous Improvement (CI) strategies for the manufacturing and service sectors. Continuous Improvement (CI) is the core objective of every organization seeking to achieve quality and operational excellence while also enhancing performance (Assarlind et al., 2012).

Lean Six Sigma is one strategy that depends on the basis of a cohesive team effort to develop execution further or improve performance by deliberately eliminating waste and diminishing variation. Lean Six Sigma is a process improvement methodology that integrate Lean Manufacturing and Six Sigma. to eliminate or minimize the eight types of waste (Muda): overproduction, defects, underutilized talent, waiting, inventory, transportation, extra-processing, and motion. In addition, Lean Six Sigma continuously reduced process flaws and waste known as a non-value-added activity (Summers and Donna, 2011). The execution of Continuous Improvement strategies like Lean Six Sigma (LSS) help business leaders to accomplish quality product, increase production and benefits (Alexander et al., 2019). Up to this point, Lean Six Sigma and Six Sigma have been carried out widely and

effectively in the bigger industrial units. To indicate either Lean Six Sigma is effectively executed, the Critical Success Factors (CFSs) of LSS should be recognized. CSFs are a crucial critical factor for the success of any project, company, or organization. For that reason, special and continuous attention must be given to several important aspects to ensure that they can be adequately implemented, thus ensuring the enterprise's success. In addition, if any essential success criteria are lost or absent throughout the LSS program's creation and execution, this might mean wasted resources, time, money, and effort (Antony and Banuelas, 2002).

However, the success of implement Lean Six Sigma in SMEs is still uncertain nowadays. Many authors already argue about the use of Lean Six Sigma in SMEs industries. Nonetheless, many vital questions remain unanswered nowadays, and future research is required to prove whether application of LSS method will bring success to SMEs industries. In addition, globally has been attacked with pandemic Covid-19 that had so many destructive impacts on the SMEs industry. The Coronavirus pandemic is not only a wellbeing debacle, and the Covid-19 has disrupted the economic sector. This situation will be adding more obstacles and challenges to SMEs to apply Lean Six Sigma, and the success of these initiatives in SMEs will be vaguer. This project will analyze and understand the success factors and obstacles of implementing Lean Six Sigma as the new normal daily life (SOP) during pandemic Covid-19 and determine whether SMEs are still relevant to applying Lean Six Sigma during the pandemic Covid-19 condition because until nowadays uncertainty when this pandemic will end.

1.2 Problem Statement

Business leaders who utilize fruitful Lean Six Sigma (LSS) projects can recognize, analyze, and implement enhancements to processes and eliminate defects to accomplish cost-saving for competitive advantage (Albliwi et al., 2014). Starting from 11 March 2020, World Health Organization (WHO) announce that Covid-19 was a pandemic. As Covid-19 spread, mostly all governments worldwide started to implement strict measures to save lives, for example, disallowing live occasions, requesting that residents stay indoors, and closing organizations and businesses, all of which eased back the Covid-19 spread and forestalled the over-burden of national healthcare systems. Due to the pandemic Covid-19, many

negative impacts, and multiple pressures to the organization from stagnant production, declining demand, tight logistics, and challenges in employment caused by the pandemic Covid-19, the production and operation activities of firms have been genuinely impacted, particularly for Small and Medium Enterprises (SMEs) with limited scale and weak risk management practices. This pandemic situation has enhanced the problem statement that needs to study for this project.

After considering the circumstances and developments of the current situation from the nowadays condition pandemic Covid-19, the current problem that still occurs are there is the slightly study that has been done about the relevancies to applying Lean Six Sigma in pandemic Covid-19 condition. One of the methods implemented by the government around the world to control and slow the Covid-19 spread is by shutting down businesses, which makes SMEs one of the affected by this government order. Hence, all the obstacles to implementing Lean Six Sigma as the new normal daily life (SOP) during pandemic Covid-19 and the relevancies to applying Lean Six Sigma during the pandemic Covid-19 condition must be studied to get a better understanding solution for this problem.

In addition, the effectiveness or success factor of Lean Six Sigma is still uncertain until nowadays in SME industries at the era of pandemic Covid-19, only a few studies have been conducted related to the effectiveness of the use of Lean Six Sigma in SMEs at the era of pandemic covid. Due to this issue, the appropriate study must be conducted to study and identify the scientific answer for the problem statement.

1.3 Objectives

The objectives for this project are stated as below:

i. To clarify the success factors of Lean Six Sigma implementation in Small Medium Enterprise (SME).
ii. To analyze whether Lean Six Sigma practice is still relevant to the SMEs in current pandemic Covid-19.
iii. To recommend do(s) and don't(s) in implementing Lean Six Sigma at SMEs in the era of pandemic Covid-19.

1.4 Project Scope

This project will cover on:

i. Success factors of Lean Six Sigma implementation in manufacturing sector and service sector.
ii. Analysis of the success factors and also obstacles of implementation Lean Six Sigma in SMEs.
iii. Analysis of the implementation of new normal in era of pandemic Covid-19.

1.5 Project Significances

By conducting this project, it will contribute to the SMEs industries, which can help to give them information on whether Lean Six Sigma practices are relevant and effective enough to be applied in SMEs industries during this pandemic Covid-19 or not. Due to the limited study of the success factors applying Lean Six Sigma in SMEs industries, this project will become the most important study that needs to be conducted to get more information on how far Lean Six Sigma will be effective to be applied by SMEs industries. This project will also recommend the best solution do(s) and don't(s) in implementing Lean Six Sigma in the era of pandemic Covid-19 at the end of the project based on the results achieved through the analysis that has been conducted in this project.

Nowadays, many SMEs have not dared to implement Lean Six Sigma because Lean Six Sigma requires a high cost which can put a burden on SMEs, especially at this time of pandemic Covid-19 (Julian Syaputra et al., 2020). By conducting this project, the results of this study can be guided and give an opinion to the SMEs industries before them to decide whether to implement Lean Six Sigma on their business or not, and this can help the SMEs industry es to plan and can properly manage their strategy when they decide to implement Lean Six Sigma (LSS) in their business. All of this will be found out at the end of this project.

Finally, by conducting this project, the outputs of this project will be recommended do(s) and don't(s) in implementing Lean Six Sigma at SMEs in the era of pandemic Covid-19. These will be beneficial and guidelines for SMEs to plan and manage their strategy.

1.6 Organization of the Report

Chapter 1 explains the overview of the project. This chapter consists of a background of the study, problem statement, significance of the study, the objective, scope of the research, report organization and conclusion.

Chapter 2 reviews the introduction of theory basic concept for Lean Six Sigma. This chapter is also followed by exploring the history of integrating the six sigma and lean. Moreover, the success factors of Lean Six Sigma and application of Lean Six Sigma in SMEs also will be reviewed in this chapter. Next, this chapter also reviews the implementation of Lean Six Sigma in SMEs and all the Covid-19 obstacles for nowadays also explained in this chapter.

Meanwhile, Chapter 3 focuses on the method that will be the approach for the project. All the methods that will be implemented in this research will be explained more such as the research design, research approach, data collection and data analysis of the project. This chapter will discuss the methodology in more detail.

CHAPTER 2

LITERATURE REVIEW

This chapter reviews the previous research related to the Lean Six Sigma background and history of integration of Lean Six Sigma. Moreover, the overviews about the success factors in implementing Lean Six Sigma in industries will be reviewed in this chapter. Finally, this chapter discusses the implementation of Lean Six Sigma in SMEs and the obstacles of pandemic Covid-19 in manufacturing business.

2.1 Lean Six Sigma

Pepper and Spedding (2010) claim that Lean Six Sigma (LSS) is a management philosophy that integrates two elements of Lean Manufacturing and Six-sigma in order to enhance an organization's processes and results. Lean Six Sigma is one hybrid Continuous Improvement (CI) Initiative. Lean Six Sigma combines the concepts of "Lean Manufacturing" emphasis on waste reduction with the "six sigma" emphasis on quality improvement as a means of increasing efficiency and lowering costs across all processes. Organizations adopt LSS, Lean, and Six Sigma to improve their performance and competitiveness. A recent study by Albliwi et al. (2015) states that from the research made, when it comes to improving operational excellence in manufacturing and other industries, Lean Six Sigma (LSS) has become a popular tool.

2.1.1 Lean Manufacturing

Lean manufacturing broadens the scope of the Toyota production philosophy by encompassing the five components of "the customer management process, the product development process, the enterprise-wide policy emphasizing process and the supplier management process "(Holweg, 2007). The lean vision's base remains a concentrated effort on a single product and its value chain (identification of non-value-added and value-added operations), as well as the goal of eliminating all waste, that known as MUDA, throughout the system's various sections and functions. There have been seven distinct types of garbage identified it is waiting, over production, defects, inventory, motion, over processing and transporting.

The first stage in applying lean by determine non-value-adding and value-added processes. Next, Value Stream Mapping (VSM) arose in the function and keep continues to provide such a reliable qualitative analytical tool this will happen if implemented appropriately (Rother and Shook, 1999) It also gives the scope of a project by identifying the system's existing state and planned future state. Initially, lean manufacturing ideas were applied to huge industrial operations with high volume and low variety Facilities. Top management must demonstrate leadership and commitment in order to embrace and implement the lean method. This necessitates effective communication and feedback. across the organization. The production floor space was reduced in this scenario, resulting in vacant space that maybe sold for the money. These activities are referred to in this article as "common sense"; this can result in lean being ignored as a method of improvement and certain lean tactics being counter-intuitive (reducing inventory).

2.1.2 Six Sigma

As it is now known, Six Sigma invented at Motorola in the 1980s by Bill Smith as a reliability engineer (Brady and Allen, 2006). The phrase "Six Sigma" mention of the statistical measurement of a system's defect rate. It provides a systematic and structured approach to process improvement, reducing defect rate of 3.4 defects per million chances (Brady and Allen, 2006). Pande et al. (2000) presents some interesting examples

distinction around 99 percent quality and the better rate of Six Sigma quality in a variety of different setting to assist clarify the implications of Six Sigma defect rates inside a system. Six Sigma provides structure to process improvement by outlining Deming's plan-do-check-act cycle in greater detail and directing the effort through a five-stage cycle of define-measure-analyze-improve-control (DMAIC) (Andersson et al., 2006). Each step of the DMAIC is associated with a set of techniques and tools, for example design of experiments, response surface methodology, and statistical process control which offer the user with a comprehensive toolbox of techniques for measuring, analyzing, and improving critical processes necessary for bringing the system under control (Keller and Paul, 2004).

As well-known Six Sigma methodology are implemented within a systematic problem-solving methodology known as DMAIC (Define-Measure-Analyze-Improve-Control). The organized steps are as follows: Define the improvement activity's objectives; Measure the present system; Analyze the system for determining how to narrow the gap in between system's or process's current performance and the anticipated outcome; Enhance the system; Supervise the new system. Training key personnel is crucial for properly implementing the DMAIC cycle and achieving meaningful results, as is top management buy-in if the program is to succeed. Management must take an active role in determining which projects to focus freshly trained Six Sigma teams on and ensuring that the necessary resources are accessible (Raisinghani et al., 2005). Prior to commencing on the Six Sigma journey, the responsibilities necessary for implementation must be defined and communicated throughout the company so that everyone involved understands their responsibility (Pande et al., 2000). It is critical to understand Six Sigma as a philosophy and a scientific approach, which is gaining recognition (Keller, 2001).

Six Sigma is well documented in the literature for its application in a range of industries. Motorola and General Electric are the most well-known examples in the manufacturing industry (Pande et al., 2000). However, successful in the construction project and accounting processes (Brewer and Bagranoff, 2004). As with any endeavor at continuous improvement, management commitment and open communication are critical for success. In response, Six Sigma emphasizes quantifiable financial returns through one sequential and disciplined approach. It builds an "infrastructure of champions" within the organization through the introduction of "belt" qualifications (green, black, master black) to lead the charge in data-driven decision-making for improvement efforts (Antony and Bhaiji, 2004).

2.1.3 The Combination of Lean and Six Sigma (Lean Six Sigma)

Individual Lean and Six Sigma programs share certain characteristics, including a concentration on a process of continuous improvement, customer satisfaction, extensive staff involvement, and root cause analysis (Laureani and Antony, 2018). Each of these techniques has been used by numerous firms to enhance their business processes (Aqlan and Al-Fandi, 2018). The hybrid LSS strategy enables organizations to address various distinct issues by combining tools and techniques from both initiatives. The term "Lean Six Sigma" refers to synthesizing lean and Six Sigma idea (Sreedharan et al., 2018). The combination of lean and Six Sigma attempts to improve every aspect of an organization. Whereas Six Sigma is applied by a small number of highly skilled employees within an organization, lean empowers and educates everyone to eliminate non-value tasks. If the two are executed in isolation, the conclusion may be that neither is carried out properly; they will be hampered by one another's organizational needs (Harrison, 2006). Again, this may result in two distinct subcultures within the organization, each competing for the same resources, etc (Smith, 2003).

Lean Six Sigma is also widely acknowledged as a powerful technique for leadership development. Work processes of all types are altered because of these shifts. Lean Six Sigma introduces principles, methodologies, and tools for process improvement. Thus, Lean Six Sigma is a useful tool for leadership development since it prepares leaders for their position as change agents. It is necessary to implement Lean Six Sigma because businesses and individuals require a technique for improving and problem resolution. Efforts to improve processes do not occur on their own. A systematic strategy for improvement is required to increase performance as evaluated by quality, cost, delivery, and customer happiness. Customer requirements are constantly changing and expanding. Cash flow is always crucial to an organization's success. Profitability enhancements generate the funds required to fund innovation and development. Lean Six Sigma outperforms earlier techniques by integrating the people and parts of the process of process improvement (Snee, 2010) .Indeed, a large firm aware of initially concentrated on process management, then on customer attention, and finally on process improvement, and ultimately on managerial leadership throughout ten years with little or no connection and integration of the parts.

The five-phase improvement method defines, measures, analyses, improves, and controls (DMAIC) sequences and effectively connects essential statistics and other tools for

process improvement. Snee and Hoerl (2004) emphasized this is not a novel concept and no other approach has accomplished this as effectively.

2.2 Critical Success Factors of Lean Six Sigma.

Over the years, numerous research studies have focused on the benefits of implementing LSS principles in the industry (Dumitrescu et al., 2011) . Nonetheless, numerous studies on essential success criteria for LSS applications in electronics manufacturing services (EMS) directed at multinational corporations (MNCs) in Malaysia indicate that only a small percentage of LSS implementations are effective. Psychogios et al. (2012) identify significant barriers to LSS implementation in their study, including a lack of understanding of LSS, a lack of awareness of the importance of continuous quality improvement programs, and a lack of strategic orientation and working mindset. Thus, variables such as a robust training program, teamwork, and top management commitment have been identified as critical to the success of lean deployment (Piercy and Rich, 2009). Additionally, employee engagement requires an understanding of lean processes and their application in their daily jobs, as well as an organization's awareness and willingness to improve (Radnor and Zoe, 2008), and convincing employees to accept changes to the organization's working culture (Dahlgaard and Park, 2006).

It is critical to understand the critical success factors for LSS practices on business performance in the EMS industry, as measured by operational and organizational performance (Gorantiwar and Shrivastava, 2014). However, successful manufacturing process implementation requires not only the strengthening of standard operating procedures (SOPs) or the use of various tools such as Lean, Six Sigma, kaizen, DMAIC, and others but also the process of matching these tools to the environmental culture and available resources within the organization in order to achieve effective implementation results (Gorantiwar and Shrivastava, 2014).

2.2.1 The Relationship Between LSS critical success factors with performances

Numerous elements contribute to the success of LSS implementation. Critical success factors are critical to the success of any initiative, such that if the factors' associated objectives are not met, the initiative's implementation will fail. According to Jayaraman et al. (2012) critical success factors are characteristics that a business must possess to achieve maximum competitive leverage. Additionally, the scholar emphasizes that critical success determinants are not the aims themselves, but the action required to ensure that organizations achieve their stated goals (Jayaraman et al., 2012). Numerous businesses/organizations face obstacles while implementing Lean Six Sigma using some of the Lean Six Sigma tools. These obstacles could be attributed to factors for example the organization's use of LSS tools/initiatives. Additionally, the problems associated with Lean implementation encompasses all obstacles encountered during the implementation process, including organization's executives, organizational culture, the management, and the technical issues (Taleghani, 2010).

Numerous research publications concluded that top management support is critical for the deployment and implementation of LSS projects to be effective establishes a positive correlation between the LSS's success and the business's financial impact. Psychogios et al. (2012) stated that implementing process management methodologies is doomed to fail without management commitment and support. Additionally, Dahlgaard and Park (2006) discovered that achieving a significant effect on TQM, LSS, and Six Sigma deployment required an organizational culture that is proactive in minimizing waste and achieving organizational excellence through effective leadership. As a result, and it states that management's commitment to LSS practices has a beneficial effect on performance.

Financial competence is a critical aspect in determining a company's ability to implement LSS. Investments in LSS include professional training, consultancy, and software licensing purchases necessary for a well-formulated LSS project. Jayaraman et al. (2012) identified financial capabilities as a success factor for LSS adoption because it requires some investment. Thus, it is hypothesized that the financial capabilities of manufacturing organizations in Malaysia affect the effective deployment of LSS and, as a result, the organizations' performance. The following hypothesis is produced as a result, and it states

that the financial capabilities of an organization in implementing LSS have a favorable impact on its performance levels.

Several studies have discovered knowledge and training have a favorable and statistically significant impact on the process improvement of LSS. It requires extensive training and expertise in LSS technologies such as lean-kaizen-process mapping, 5S and similar techniques. According to research in various studies, there is a positive association between LSS success and training (Jayaraman et al., 2012). Training in total quality management, lean manufacturing, and Six Sigma includes applying core values like trust, respect, integrity, and honesty, as well as core competencies such as emotional and intellectual competencies (Dahlgaard and Park, 2006). Although it has been discovered that there are considerable disparities in the degree of emphasis placed on training, job enrichment, and employee empowerment among organizations, these variances are thought to impact the various levels of intensity placed on total quality management. The following hypothesis is produced as a result, and it states that training provision for LSS practices has a positive influence on performances.

When the training has been completed and resources have been allocated, another essential aspect in ensuring the effective implementation of LSS is a thorough understanding of LSS practices throughout the organization's workforce (Julien and Tjahjono, 2009). An understanding of the entire process of LSS application as a performance improvement tool to improve the organization's overall performance is required. In order to be successful in lean and Six Sigma initiatives, it is necessary to have a solid understanding of the processes, tools, and methodologies involved, Taleghani (2010) also stated that Six Sigma practitioners should be familiar with a well-defined set of metrics for comparing process performance to customer requirements, such as, cost of poor quality, defect rate and rolled throughput yield, in order to achieve success with their Six Sigma implementation efforts. The following hypothesis is produced as a result, and it states that Understanding LSS tools and their implementation has a beneficial effect on performance.

2.3 The Impact of pandemic Covid-19 on SMEs

It has been well known that the COVID-19 pandemic has increased the likelihood of individual business risks (Ursachi, 2021). It is necessary to develop a new systemic risk management strategy that considers the pandemic risk to reduce their impact. Responding to the virus's spread in separate nations of the European Union at different times and in different ways has resulted in complicated and broad negative economic effects, influencing the economic processes and the current direction of development of society (Kuzmenko, 2020). The industrial sector (59.9 %) and the hospitality and foodservice industry (59.6 %) are particularly vulnerable to the economic downturn. A disproportionately big proportion of these businesses faces the prospect of losing financial liquidity and maybe declaring bankruptcy (39.4 % and 38.5 %, respectively). Reduced demand becomes an issue for 45% of enterprises, posing a threat to their development and their financial and economic well-being. The economic recession is an increase in market competitiveness, which is the most significant impediment to the development and long-term viability of the economic and financial status of Small and Medium-sized Enterprises (SMEs). Furthermore, macroeconomic variables, such as inflation, interest rates, and the exchange rate, pose a considerable threat to the enterprises' operations. Small and Medium-Sized enterprises (SMEs) have report they cannot develop mutually beneficial ties with customers, which increases the likelihood of failure to satisfy customers' expectations.

Following the onset of the pandemic in 2020, there has been a shift in the view of business risk as well as its management (Borocki et al., 2019). To ensure the continued functioning of businesses in most countries, several forms of financial tools are employed. The purpose is to finance a portion of the entire amount of costs incurred due to a suspension, closure, or slowdown in the activities of businesses. As a result of reducing the likelihood of an economic depression, the fundamental goal of this sort of assistance is to maintain the economic activity of small- and medium-sized enterprises by providing financial coverage for potentially lost profits (Grondys et al., 2021). Many governments have devised quick solutions to assist the operations of the SME sector, such as, tax reductions, direct financing, financial guarantees, other forms of assistance and low-interest loans among other things.

Even more clear are the differences when there is a pandemic in place. Following the findings of the most recent research Grondys et al. (2021) on small and medium-sized firms

(SMEs), 43 % of small, and medium-sized enterprises (SMEs) does not restore their level of turnover from the beginning of that time. Because of the coronavirus, many of these businesses will not survive another year on the market. As revealed by the Confederation Lewiatan's research, which had the goal of assessing the threat the COVID-19 pandemic posed to the country's economy, the findings of this study are encouraging. According to the collected data, 94 % of companies have felt the pandemic's effect and the limits levied as a result, and almost half of these companies consider the changes that have taken place to be extremely concerning. Compared to the same period last year, 52 % of businesses reported a reduction in sales in the 30 days before the poll, according to the "COVID-19 Business Pulse Survey (COVBPS) Poland" study. Over 70% of businesses cope with a decline in sales while maintaining or increasing costs or with a decline in revenues while maintaining or increasing costs (Grondys et al., 2021).

2.4 Lean Six Sigma (LSS) Implementation at SMEs

According to the research, people's core beliefs, vision of continuous quality improvement and educational level identified as important elements in developing LSS preparedness in manufacturing SMEs. A holistic approach to six-sigma model and lean manufacturing was developed by (Thomas et al., 2008). It was developed, refined, and implemented in close collaboration with a subject company. As a result, the approach's effectiveness is assessed, emphasizing the advantages a chieved by the host organization as a result of the new approach's implementation as measured against internal business measures. Borocki et al. (2019) conducted an assessment of the companies' present situations to determine their suitability for lean implementation and the problems that may arise throughout the implementation process. A significant positive relationship was identified between the core competence of individuals and organizational culture and readiness for implementing LSS in manufacturing SMEs, according to the findings of the study. Companies will become more aware of their capabilities if they identify their flaws early on. Furthermore, it can improve their readiness for lean implementation and make them more consistent in their work processes.

According to Chakrabort (2019), the overall answer rate for India was 19.52 %, while the overall response rate for Namibia was 26.46 %. Small and medium-sized enterprises (SMEs) in both nations provided comparable and different replies. Similarities can be found in the limited adoption of quality management practices and the restricted usage of tools and procedures. Ursachi (2021) found that adopting lean manufacturing practices is generally modest and still evolving in food processing SMEs. The primary impediments to food SMEs implementing lean manufacturing principles stem from the food sector's unique characteristics, including very perishable goods, sophisticated processing, extremely variable raw materials, and recipes, and unexpected demand. Additionally, a lack of knowledge and resources complicates the lean journey for food processing SMEs.

Two lean criteria, cross-functional, strategic partnerships with suppliers, development teams, and cross-organizational design., had a significant impact on most key performance indicators (Sharma et al., 2015). Certain lean criteria were discovered to have a detrimental effect on the overall competitiveness of machine tool manufacturers. Achanga et al. (2006) identifies five crucial criteria that influence the success of lean manufacturing implementation in SMEs. Among other elements, leadership, management, finance, organizational culture, and skills and knowledge are the important challenges for adopting lean manufacturing in an SME environment. According to Sharma et al. (2015), there are sixteen impediments to the deployment of LSS in Indian SMEs. This study identifies twelve techniques for overcoming these impediments. The analysis reveals that the most critical method for overcoming the barriers to deploying LSS in Indian SMEs is "effective management. “The primary reason SMEs do not apply Lean Six Sigma is a lack of system knowledge and awareness and inadequate resources. Significant performance differences between Lean Six Sigma or lean firms and ISO certified companies were discovered in organizational performance's strategic and operational stages. According to (Kumar et al., 2009) many small and medium-sized businesses are unaware of Lean Six Sigma and lack the resources necessary to conduct a Lean Six Sigma project.

Additionally, it was discovered that SMEs do not widely adopt Lean Six Sigma. The most critical variables affecting the effective dissemination of Lean Six Sigma in SMEs are management involvement and participation, connecting Lean Six Sigma to customers, and connecting Lean Six Sigma to business strategies. According Raisinghani et al. (2005) the initial purpose of Six Sigma is to eliminate impairment. Defect reduction will increase yields, and increased yields will significantly improve consumer satisfaction. Reduced Lean Six

Sigma defects are meant to result in cost savings. It is process-oriented and seeks to identify areas for improvement of the processes with the systematic measurement. When performed incorrectly, Lean Six Sigma implementations might have some negative repercussions.

CHAPTER 3

METHODOLOGY

This chapter discusses the research approach, method strategy, data collection, and data analysis techniques that were chosen to accomplish the current research objectives. The following sections explain methodology for each objective of this project.

3.1 Project Planning

This section explains the procedures and processes needed to complete in PSM 1 and PSM 2. This project is divided into two stages whereby PSM 1 includes an introduction, literature review, and methodology purposes, while PSM 2 will execute the methodology to achieve objective 1 until objective 3 includes result and discussion, conclusion, and recommendation. Figure 3.1 below summarizes the guidelines and process of the entire project start from the beginning until the end of this project.

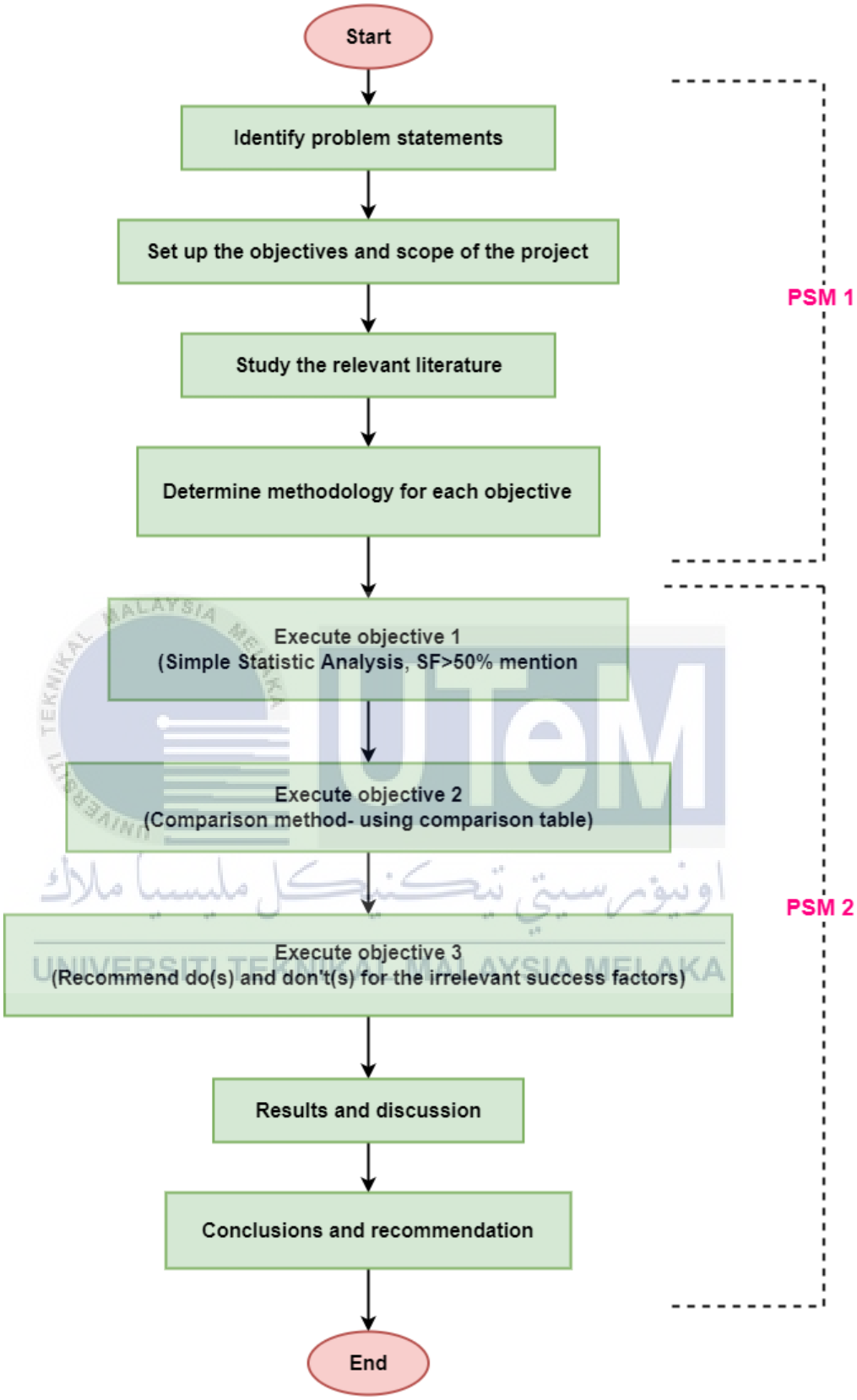

Figure 3. 1: Guidelines of the Project

3.2 Project Methodology

Project methodology is described as a strategy and technique that outlines a method for collecting and analyzing data in depth. Data collection is classified into quantitative, qualitative, and mixed techniques. Quantitative data is called numeric data, and qualitative data is referred to as non-numeric data. Qualitative data focuses on aspects that are difficult to quantify numerically, such as emotions, attitudes, and sentiments. The mixed method is a method that combines qualitative and quantitative techniques. This project employed a mixed technique approach to understanding the phenomena in their natural environment. The mixed-method technique incorporated data from prior journal or article publications and statistical data to address the study concerns.

3.3 Method Design

A method design is defined as a structure for collecting data to address the research objectives. There are four fundamental categories of research: surveys, experiments, Secondary Data Analysis, and case studies. After deciding on a research approach and a framework, the following step is to choose a research method.

This project followed a secondary data analysis to analyze the relevance of implementing Lean Six Sigma in SMEs in pandemic Covid-19 nowadays. In this project, secondary data analysis is designed to explore and collect the data from the previous educational research and commercial information source such as journals, articles, and magazines to obtain data regarding the success factors of Lean Six Sigma (LSS) implemented in SMEs and to identify the relevancies of Lean Six Sigma (LSS) applies with all the obstacles in current pandemic Covid-19.

Secondary data analysis is the most suitable for this research because most of the data used in this study are publicly available. In contrast to primary research, where data must be collected from scratch, there are numerous sources from which relevant data can be

collected and used. This is a less costly and time-consuming process because the data required is readily available and inexpensive when extracted from authentic sources. The acquisition of data requires a minimal expense.

3.3.1 Unit of Analysis

The word "analysis unit" referring to the things that is the subject of the investigation. For this project, unit of analysis is the success factors of implemented Lean Six Sigma (LSS) SMEs and their relevancies to be applied with the pandemic Covid-19 obstacles nowadays.

3.3.2 Data Collection and Data Analysis

Data collection is collecting and analyzing relevant characteristics in order to address the study questions and evaluate the results. There are two types of data which are primary data and secondary data. In this research, secondary data are used. The data will be collected from previous educational research and commercial information sources such as journals, articles, and magazines. The references of journal articles and book will be collecting from the database such as Scopus, Science Direct and Google Scholar.

3.3.3 Methodology for Objective 1

Figure 3.2 shows the flowchart of the data collection and analysis processes to achieve objective 1 of the projects. For data collection in this methodology, the search criteria will focus on the data's time frame (which was 2015-2021).

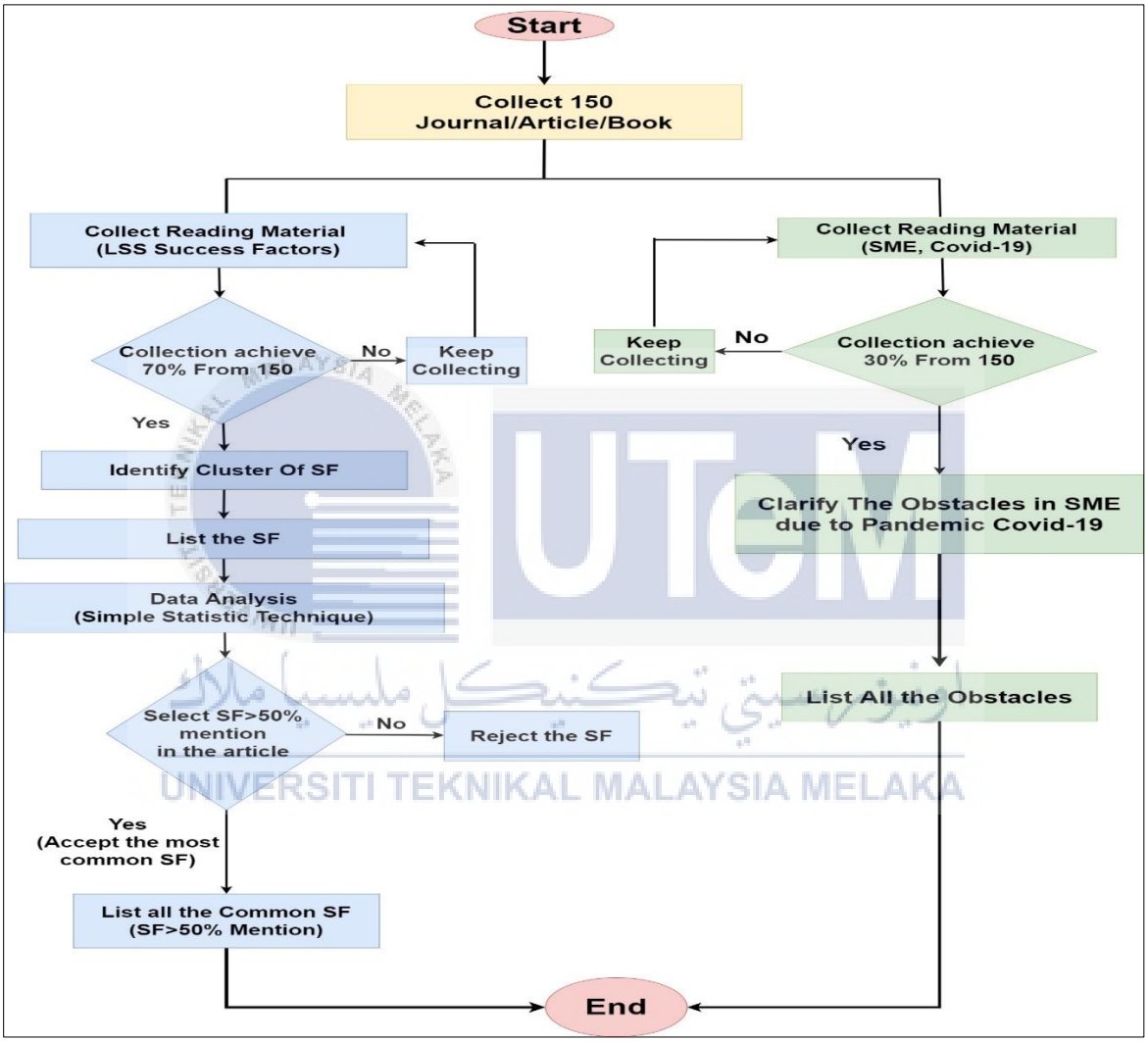

Figure 3. 2: Flowchart Process to Achieve Objective 1

The keyword of the search text, i.e., success factors of Lean Six Sigma (LSS) or SMEs or Covid-10 Obstacles. The researcher has targeted the material collection in 150 journals or articles for this project, an example of journals titles such as International Journal of Quality and Reliability Management, International Journal of Lean Six Sigma, International Journal Productivity, and Quality Management. In the beginning, the collecting material needs to be divided into two categories: reading material regarding Lean Six Sigma

(LSS) success factors need to achieve 70% equivalent to 105 from the 150-reading material. The other categories are the SMEs and obstacles of pandemic Covid-19 that need to collect 30% of the total reading material.

In the process flowchart from Figure 3.2, at the left side, the process starts with collecting the data, which is reading material. The reading material needs to achieve the collection target before proceeding to the next step. After the collection meets the number of data requirements, the next step is to start the reading and identify the Lean Six Sigma (LSS) success factors cluster. List all the success factors found from the reading. Next is the data collection process regarding the SMEs and the Pandemic Covid-19 obstacles. The data collection is similar to the first categories. Firstly, collect the reading material regarding the SMEs and the Obstacles of the pandemic Covid-19. The collection needs to achieve at least 30% of the total 150 reading material that has been set for this research. After the collected journal has achieved the target, the next step is to start the reading and clarify the obstacles in SMEs due to the pandemic Covid-19. At the end of this data collection, a list of the obstacles will come out.

Next is data analysis. In this phase list of the success factors will be analyzed using simple statistic frequency calculation. Based on the statistic, the success factors that more than 50% has been mentioned in the material reading will be selected and accepted as the most common success factor in implementing Lean Six Sigma. The percentages statistics for the less mentioning success factors will be considered a rejected list of Success Factors.

3.3.4 Methodology for Objective 2

Figure 3.3 describes the procedures used to analyze the data to achieve the second objective of this research. The output of the methodology in objective one will be used as a data collection in methodology objective two, which is the list of Common Success Factors and Pandemic Covid-19 obstacles.

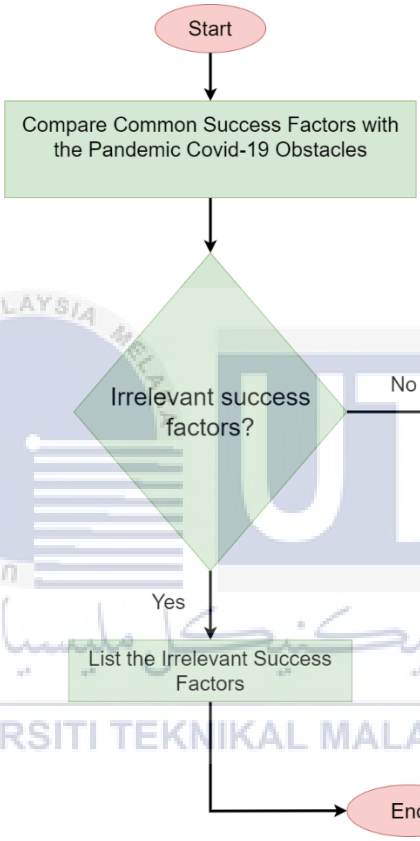

Figure 3. 3: Flowchart Process to Achieve Objective 2

The data analysis process starts with comparing the most common Lean Six Sigma (LSS) success factors with the obstacles in SMEs due to the Pandemic Covid-19, which has been obtained from the previous methodology in objective 1. This comparison method will decide the relevancies of implementing Lean Six Sigma (LSS) in SMEs during the pandemic Covid-19 situation. To analyze the data analysis, a comparison table will be created to make the data are accessible and properly managed to be compared. The outcome from this methodology is to decide the relevancies of success factor Lean Six Sigma in SMEs during the pandemic Covid-19 situations.

3.3.5 Methodology for Objective 3

Figure 3.4 describes the procedures used to analyze the data to achieve the third objective of this project: The data collection for this methodology will be obtained from the output of the methodology in objective two, which is the list of the irrelevant success factors.

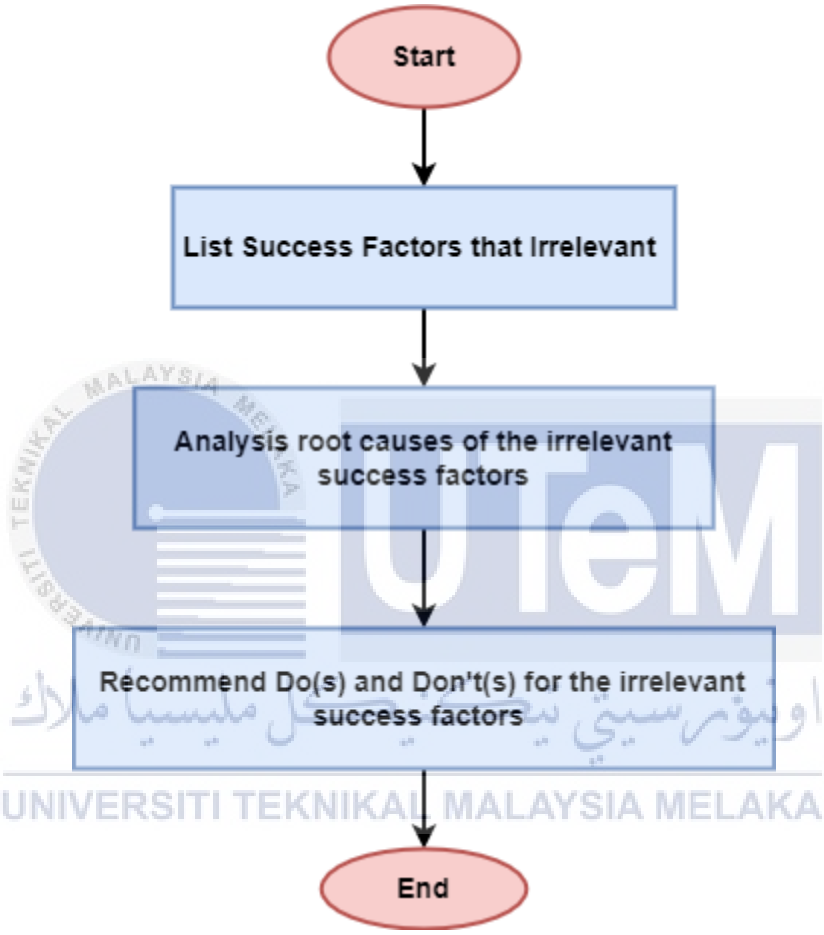

Figure 3. 4: Flowchart Process to Achieve Objective 3

The data analysis will start with the analysis root causes of the irrelevant success factors based on the list of the irrelevant success factors obtained in the output of methodology. After analyzing the root causes, next to recommend do(s) and don't(s) for the irrelevant success factors to overcome the irrelevant success factor in applying the Lean Six Sigma at SMEs in pandemic Covid-19 situation. After done with the recommendation, the last step is to provide charts of do(s) and don't(s) in achieving success of implementation Lean Six Sigma (LSS) in SMEs with the obstacles of Pandemic Covid-19.

3.4 Summary

This project there are divided into PSM 1 and PSM 2. To fulfill the requirement of PSM 1, this report must complete the chapter of introduction until the methodology of the project. Therefore, in this PSM 1 report, all the methodology to be used to achieve the project objective has been set, and proper planning to get ready for the execution in the PSM 2 later. Then, all the results and discussion of the methodology outcome will be discussed in PSM 2. This project has three main objectives that has been state in this project report. These three objectives will fulfill the requirement and answer the questions of this project.

CHAPTER 4

RESULTS AND DISCUSSION

This chapter discusses the results obtained from the project. This chapter began by showing the impacts and obstacles of pandemic Covid-19 to SMEs from the journal reading. Then, the success factors of LSS have been identified and divided into 13 clusters. Next, after the analysis, the most common success factors were selected from the 13 clusters of LSS success factors that have been listed before. After that, the most common LSS success factors will be analyzed in the relevancies of implementation at SMEs in the era of pandemic Covid-19. Then, all the irrelevant success factors have been given recommendations do and don't for the success factors to be implemented in the era of the pandemic. Finally, the analysis of the results and the solution were presented and discussed in this chapter.

4.1 Objective 1: To clarify the success factors of Lean Six Sigma implementation in Small Medium Enterprise (SME).

In this objective, the main focus is to develop a list of the LSS success factors and the impact/ obstacles of pandemic Covid-19 on SMEs. At the end of this objective, the most common LSS success factors were identified and listed.

4.1.1 Data Collection

The data collection is collected from previous educational research and commercial information sources such as journals and articles. The data collection is divided into two categories which is Impact and Obstacles of pandemic Covid-19 to SME (50 references) and Lean Six Sigma (LSS) success factors (100 references).

4.1.1.1 Impact and Obstacles of Pandemic Covid-19 on SME Operations.

This section will show the results of the impact and obstacles of pandemic Covid-19 on SME operations. The table below shows the results obtained from the reading material of 50 references.

Table 4. 1: Impact and obstacles of pandemic Covid-19 on SME operations

Impact and Obstacles	References
1. Public Movement Control (MCO). Restrictions on community activities in daily activities. Live events were prohibited, individuals were asked to stay indoors, and businesses were closed, stopping the spread of Covid-19 and averting the overburdening of national healthcare systems.	(Amirudin et al., 2021), (Maison et al., 2021), (Lu et al., 2021)
2. Limitation of direct contact with people	(Maison et al., 2021)
3. Difficulties with their online connectivity and communications with customers and suppliers.	(EY Malaysia, 2021), (A. Tong & Gong, 2020)
4. Lockdown, Operation disruption inability to operate during normal business hours- Loss of sales due to the closure of business operations. Declining short-term revenue and incapacity to resume operations.	(Adam et al., 2021), (Maglakelidze & Erkomaishvili, 2021), (Lu et al., 2021), (Che Omar et al., 2020), (Uthamaputhran et al., 2021), (Shinozaki & Rao, 2020)

Table 4. 1: Impact and obstacles of pandemic Covid-19 on SME operations (continue)

Impact and Obstacles	References
5. Working from home. Most staff required to work remotely or from home	(Orsmond, 2021)
6. Cash flow problem- No income while being obligated to pay for essential expenses such as staff, salaries, rent, and company loans.	(Che Omar et al., 2020), (Adam et al., 2021), (Biz Pulse, 2020), (Tajudin et al., 2021), (Parveen, 2020), (Li et al., 2022), (Collis, 2021)
7. Delays in receiving supplies, challenge to access the production materials	(Ernst & Young. (2020), (Maglakelidze & Erkomaishvili, 2021)
8. Barriers to market entry	(Maglakelidze & Erkomaishvili, 2021)
9. Shortage of professional staff to handle change,	(Maglakelidze & Erkomaishvili, 2021), (Collis, 2021)
10. The contrasting trajectories between online and offline economic activities	(A. Tong & Gong, 2020), (Collis, 2021)
11. The ability of personnel to adapt the change	(Irawan, 2020), (Goforth, 2021)
12. Declining market demand and disruption to supply	(Sun et al., 2022), (Goforth, 2021)
13. The government has mandated that all enterprises that are not necessarily shut down their activities.	(Biz Pulse, 2020),

4.1.1.2 Lean Six Sigma (LSS) Success Factors

Table 4.2 shows all the clusters of success factors in Lean Six Sigma. For this project, the success factors are divided into 13 clusters. This table also shows the frequency number of success factors mentioned in the 100 references that have been read. The number in these results represents the references code number. This code is used to ensures a more systematic to arrange the results.

Table 4. 2: List of Success Factors

The Cluster of LSS Success Factors	Number of mentions (Code)
1.Top Management involvement and communication	[1-9], [11-19], [22-24], [26-29], [31-46], [48-50], [53], [55-59], [61], [63-66], [70-74], [77-89], [91], [93-99]
	Total = 81
2. Leadership, Project management skills and teams	[1-9], [11], [13], [16-18], [20-21], [23], [27], [29], [31-32], [34], [37-40], [42-44], [47-49], [51-52], [55], [56-58], [60-62], [64], [66], [69], [71], [73], [75], [77], [80-86], [88], [90], [93-100]
	Total = 65
3. Human Resource Management	[1-5], [7], [11], [37], [39], [42-43], [45-47], [52], [56-57], [64], [69], [71], [79], [80],
	Total = 21
4. Linking LSS to the supplier and customers	[2], [4], [5], [7-8], [11], [13], [17-18], [23], [27-28], [32], [37], [39-40], [43], [52], [55-57], [61], [64], [78], [80]
	Total = 25
5. LSS Training, education and Understanding of the LSS methodology, tools and techniques used	[7], [13-14], [16], [18-19], [21-24], [26-28], [31-33], [38-42], [44-47], [50], [53-57], [59-61], [63-66], [68], [70-71], [73-74], [77-81], [83-84], [86], [88-90], [93-94], [96-99]
	Total = 71
6. Culture Change and organization culture	[1-2], [5-7], [10], [13-14], [16-19], [22-25], [27], [29], [32-33], [36-38], [41-50], [56-57], [61], [63-69], [71], [73-74], [76], [81], [84], [89], [90-91], [94-95]
	Total = 54
7.Weak Organization Infrastructure	[13-14], [16-17], [23], [25], [27], [32-33], [35-36], [39], [41], [43-44], [50], [56-59], [64], [68], [72-73], [77-78], [80-81], [86], [96-99]
	Total = 33

Table 4. 2: List of Success Factors (continue)

The Cluster of LSS Success Factors	Number of mentions (Code)
8. Linking LSS to Business Strategy	[7], [15], [17-18], [22-23], [27], [32-33], [39-41], [44], [54], [56], [61], [64], [72], [74-75], [77], [82]
	Total = 22
9.Tracking and review of LSS projects & performance	[7], [19], [20-22], [27-28], [40], [43-44], [55], [63-65], [68], [78], [84], [86], [97-98]
	Total = 20
10. LSS Project Prioritization or project selection	[7], [14], [16-18], [20-21], [24], [28], [30], [32], [35-36], [39-40], [43-44], [48], [53], [56], [59], [61], [63-64], [67], [69], [73-74], [76], [84], [86], [89], [95]
	Total = 33
11. Customer Focus or Customer Satisfaction and Measurement and Feedback	[1-5], [7], [9], [11], [31], [37], [44], [47], [52], [55], [57], [61], [63], [65], [73], [75], [79], [81-82], [85-88] [90]
	Total = 28
12. Lack of reward	[7], [12], [16-17], [28], [43], [59], [61], [64-65], [88-89], [94]
	Total = 12
13. Skilled- Employees, lack of employee awareness and employee involvement	[42-43], [45-46], [49], [51], [62], [64], [66], [76], [88], [90-91], [93], [94-99]
	Total = 20

4.1.2 Data Analysis

In this data analysis, list of the success factors will be analyzed using simple statistic frequency calculation. Based on the statistic, the success factors that more than 50% has been mentioned in the 100 of references will be selected and accepted as the most common success factor in implementing Lean Six Sigma. The percentages statistics for the less mentioning

success factors will be considered a rejected list of Success Factors. The statistics frequency mentioned for the data analysis is shown in Table 4.2.

4.1.2.1 The Most Common Success Factors

Figure 4.1 shows the results of the total statistic frequency mentioned for each success factor. From the bar chart, the most common success factors mentioned more than 50 times were easily viewed and presented well in the bar chart.

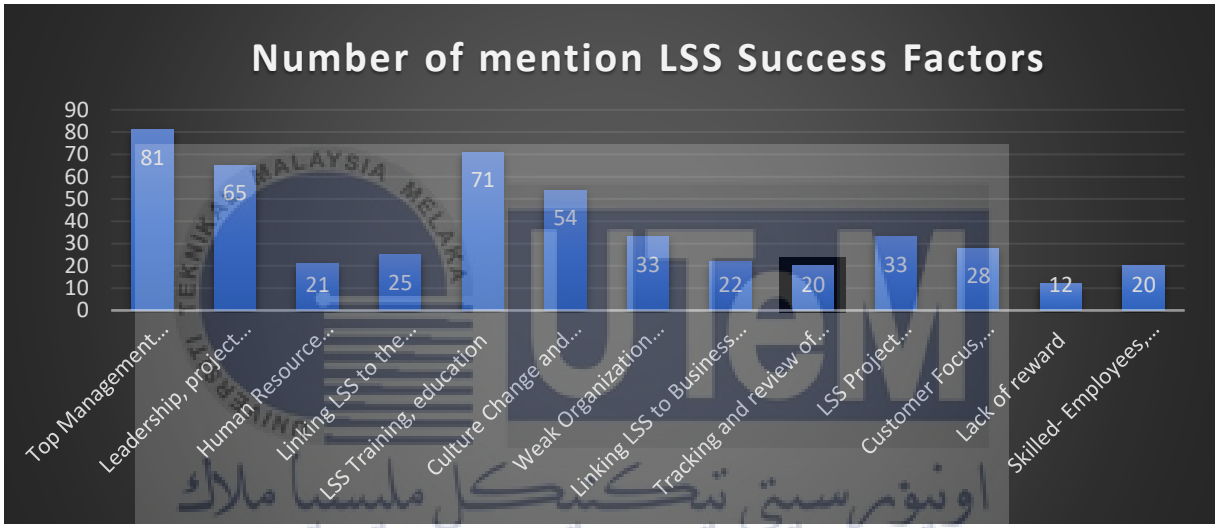

Figure 4. 1: Show the frequency number of mention for each of the LSS Success Factors

Based on Figure 4.1, the most common success factors are selected and shown in Table 4.3 below.

Table 4. 3: The most common success factor

Most Common Success Factors	Total References
1. Top Management involvement and communication	81
2. LSS Training, education, and Understanding of the LSS methodology, tools and techniques used	71
3. Leadership and Project Teams management skill	65
4. Culture Change and Organization culture	54

From Table 4.3, there are four cluster of success factors that has been selected as a most common success factor which the frequency of mentioning is over 50 from 100 of references. As show in the table, top management involvement and communication is the most common success factor which is 81 times was mentioned out of 100 references that has been read. Second most common success factors are LSS Training, education, and understanding of the LSS methodology, tools and techniques used that have been mentioned 71 times follow by the success factors of Leadership and Project Teams management skill which represent by 65 references that was mentioned. The last most common success factor is goes to Culture Change and Organization culture which is 54 times was mentioned from the 100 references. By selected the most common success factor, the objective one already been achieve.

4.2 Objective 2: To analyze whether Lean Six Sigma practice is still relevant to the SMEs in current pandemic Covid-19

In this objective, the final results are to determine the relevancies of the most common LSS success factors, whether the most common success factors are relevant or irrelevant to be implemented in the pandemic Covid-19.

4.2.1 Data Collection

The data collection for this objective are collected from the outcome in objective 1, which is the impact and obstacles pandemic Covid-19 to SME, and list of the most Common Success Factors that obtained in objective 1. Finding in objective one will be used to analyze and achieve objective two.

This objective uses comparison method to analyze the relevancies of the most common success factors in the era of pandemic Covid-19. The status of the relevancies has been decided by considering the impact and obstacles of the pandemic Covid-19 to SME

operations with the LSS success factors that identified through literature studies. This data will help to analyze the relevancies of the most common success factors.

4.2.2 Analysis of the Relevancies of the Most Common Success Factors in the Era of Pandemic Covid-19

Table 4.4 explains the definitions of relevancies in this project. All the relevancies status has been stated and decided by following this definition of relevancies.

Table 4. 4: Definition of relevancies in context of this project

Relevancies Status	Definition of Relevancies in This Project	
	Relevant	**Not Relevant**
The status of the relevancies will be decided by considering and comparing the impact and obstacles of the pandemic Covid-19 to SMEs with the most Common LSS success factors.	The most common LSS success factors are appropriate to be implemented at the SME with the current time, period, or circumstances of the Pandemic Covid-19 even in the presence of impacts and obstacles inherent from the pandemic Covid-19 but did not have a significant impact on the implementation of most common LSS success factors on SME.	The most common LSS success factors are inappropriate to be implemented at the SME with the current time, period, or circumstances of the Pandemic Covid-19 because of the presence of the impact and obstacles inherent from the pandemic Covid-19 where it prevents the most common LSS success factor from being implemented successfully.

The data collection had been collected and further analyze the relevancies of the most common success factors whether the implementation of the success factors is still relevant to SMEs in the era of pandemic Covid-19 which has many obstacles. This section also will justify the relevancies status of each of the most common success factors. Below will show

the definition, relevancies status and the justification for the relevancies status each of the most common success factors.

A1 Top Management Involvement and Communication

a. Definition

Top management involvement and participation refers to top management's direct involvement and participation in the project to ensure its success. The full implementation of Lean Six Sigma requires strategic guidance and support from top management. To ensure the effectiveness of the top management involvement, this succusses factors need a better communication with the employee. Effective communication refers to the exchange of information between persons. Communication can occur either verbally or in writing. Management and employee's communication skills must be enhanced for the team to address the issues freely. Communication between the top management with the employee may also be achieved by creating a visible dashboard in which the organization communicates the established challenges and objectives.

b. Relevancies status LSS to Pandemic Covid-19

The top management involvement and communication problem are relevant to be apply in the era of pandemic Covid 19.

c. Justification

Based on the situation when the Covid-19 pandemic hit the world with various obstacles, top management needs a high commitment of support from all levels of the management to the employee to achieve success in implementing Lean six sigma. The main obstacle that hindered this success factor from being applied in pandemic Covid-19 is that the limitation of direct contact with people was significantly reduced (Maison et al., 2021). Many workers worldwide were compelled to work from home throughout the lockdown.

This situation has resulted in limiting their communication with the management and employee. This kind of situation has made it difficult for employees and top management in a company to meet and discuss the project's issue. Management of the organization need to produce a systematic way on how to keep communicate among the employees.

Many of organization in world apply the online communication as a main way to keep communicate among the employee to make sure the workers always been updated to the work. Because of the online communication has been used, the challenge is the capability to technically equip employees with the systems and tools they need to work efficiently from home and the need to implement fast the new business procedures necessary for nowadays. This entailed providing the appropriate infrastructure and systems in their homes and just-in-time training and technical assistance. According to Tong & Gong (2020), in 2018, more than 80% of Malaysian small and medium-sized enterprises (SMEs) used computers and cellphones for business activities, while over 70% used the internet for their business operations.

This statement proves that social communication between employees and employers through online communication should not be the main problem. From the data, since 2018, more than 50% of SMEs that already implement online communication via laptop and handphone. During the pandemic Covid-19 condition, communication among the top management and the workers was not the main problem. This kind of online communication was already practiced in SMEs before the world pandemic. In addition, the widespread use of technology by users of platforms such as Zoom, Teams, and Webex has guaranteed that social connection has not entirely disappeared. From this situation, the top management involvement and communication problem should be handled and relevant in the pandemic Covid-19 condition by applying the online platform communication to communicate and give full support among the management and employees.

A2 LSS Training and Education on understanding of The LSS Methodology, Tools, and Techniques

a. Definition

In lean six sigma, Training is essential to the effective implementation and growth of the Lean Six Sigma program. Therefore, it is essential to convey the 'why' and 'how' of Lean Six Sigma as soon as possible and provide individuals the opportunity to increase their comfort through training programs. The belt system is commonly used to denote the hierarchy of skills. Understanding the tools and techniques utilized in Lean Six Sigma is critical for team members, champions, and leaders. Team members are trained and equipped with the LSS technique at the LSS training. The project manager or champion's role is to ensure that everyone on the team understands the approach and can use the tools to complete the project. Failure to grasp the technique will lead to project failure and the loss of business benefits.

b. Relevancies status LSS to Pandemic Covid-19

Due to the pandemic Covid-19 situation, this success factors are irrelevant to be apply in the era of pandemic Covid-19.

c. Justification

For this success factor, the ideal method to accomplish this is to give "hands-on" learning so that individuals can immediately apply fundamental concepts and abilities (Antony and Bhaiji, 2017). In addition, the examples and activities utilized in training must represent the demands and difficulties of the specific company. Pandemic Covid-19 has caused company operation disruption (Che Omar et al., 2020). All the SME business are close due to the lockdown that has been implemented by the government, non-essential business must cease operations, and the public has been instructed to stay at home. This obstacle will be the challenge to apply this success factor because the employee can’t practice the training of Lean Six Sigma due to the implementation of restrictions and rules that government executes.

Furthermore, in Pandemic Covid-19 situation, SME have issue or challenge regarding the cash flow problem (Adam et al., 2021; Che Omar et al., 2020; Tajudin et al., 2021). The articles stated that, due to the lockdown SME have no income, but need to pay compulsory things such as staff salary, rental, and business loans. This will make the SME business bear a lot of debt. This will affect this success factor because sending the employee to get the LSS training will need much money to bear the cost of the training. This kind of obstacles is the main factors and will make this success factor are irrelevant to be apply at SME in the pandemics of Covid-19.

A3 Leadership and Project Teams Management Skills

a. Definition

In order to successfully adopt the idea of Lean Six Sigma into SMEs, the recipient organizations must possess strong leadership qualities capable of demonstrating good project management methods. In essence, these qualities would assist the integration of all infrastructures inside an organization, providing that strong leadership and management permeate a vision and strategy for a generation while allowing for a flexible organizational structure. In addition, effective leadership eventually promotes the development of skills and knowledge within the workforce.

A team leader for a Lean Six Sigma project has outstanding obligations to ensure that team interactions are constructive and result in positive outcomes. This demanding position calls for a leader with the ability to bring out the best in a project team and solid leadership characteristics. A project team without an outstanding leader is comparable to a ship without a captain or a busy junction without a traffic signal. In other words, the team may appear to be quite productive, but they lack direction, operate in chaos, and are highly likely to fail at some time, because of that leadership will affect the management skills in Lean Six Sigma, this because the effectiveness of the team is dependent on how the leaders will manage the employee to ensure that the project will be carried out successfully.

b. Relevancies status LSS to Pandemic Covid-19

Success factors of ‘Leadership and Communication’ is irrelevant to be applied in era of Pandemic Covid-19 condition.

c. Justification

Due to the pandemic Covid-19 situation, the obstacles that to archive the success on leadership and project teams' management skills is because the ability of personnel (Irawan, 2020b). Pandemic Covid-19 has caused the changes in service and hygiene guarantee, as well as product cleanliness, will undoubtedly have an influence on the capabilities of staff or workers, as well as SMEs' leaders. The leader must learn how to effectively manage everything such as the business management, its employees, and social media for commercial reasons. During to the pandemic Covid-19, SMEs have so many obstacles to the business that needs to be handled by the leader. During the lockdown, SMEs faced are reduction in sales and profit, uncertain supply chain activity, fewer operating hours, and unstable market demand (Uthamaputhran et al., 2021). These obstacles will challenge the leaders on how to manage the team to overcome the challenges during the lockdown to ensure that the project will keep running and sustained in the pandemic era. Even if they realized before the pandemic that information, communication, and technology (ICT) have expanded in the business and SME industries, the current circumstances make the process very different and challenging. Tong and Gong (2020), stated that employers also lack technical competence since many small and medium-sized businesses are unsure how and where to digitalize their operations. The inability of SMEs to keep up with digitalization before COVID has significant implications for the performance of their businesses and their chances of surviving the MCO.

However, SMEs are still not very good at operating their businesses digitally. It makes the teams take time and hard to proceed with the business using the new digitalized business method. From all the obstacles, a leader is a leading actor that needs to show the ability to control and handle all the pressure affected from the Covid-19 on the company because good leadership will be a roll modal to the employee to keep enhance their skills and will bring the solution to overcome the SME business challenge. They consider that Covid-19 is the first pandemic ever faced by the world community. Because of this, many changes need to be adopted by the team leader, which causes all work or project progress to be disrupted during the Covid-19 pandemic. Therefore, this success factor is irrelevant to be applied in the era of pandemic Covid-19 because good leaders are always there to find solutions to control and ensure project management is always maintained as soon as possible, but all of this is need time.

A4 Culture Change and Organization Culture

a. Definition

Culture refers to the attitudes, morals, and principles of a group. To embrace Lean Six Sigma principles and techniques, the deployment of LSS necessitates a significant culture change inside the organization. These changes must also be improved by management and accepted by employees. Change in organizational culture is essential for Lean Six Sigma implementation. This aspect is standardized by earlier researchers (Coronado and Antony, 2002) who concluded that changes in culture contribute to the program's performance. Culture change is essential because if an organization undergoes changes and improvements, it will have a greater chance of achieving its goals and objectives. Successful Lean Six Sigma deployment needs an adjustment to the organization's culture and a change in employee attitudes. Therefore, success in managing change has determined that the most effective strategy to combat opposition to change is enhanced and sustained communication plan, education, and motivation

b. Relevancies status LSS to Pandemic Covid-19

Due to the pandemic Covid-19 situation, this success factors are irrelevant to be apply in the era of pandemic Covid-19.

c. Justification

This success factor has obstacles to achieve due to the pandemic Covid-19 condition nowadays. During the lockdown condition, there have a lot of change in lifestyles, occupation, and business. The lockdown impact to this success factor such as most staff are required to work remotely or from home. This obstacle is the new culture change on how the new method to proceed the work during the pandemic because of restriction on movement and non-essential businesses requires to stop operations while the public has ordered to stay home to curb the Covid-19 outbreak. Next, all the business processes need to be implemented by digitalization such as accounting, communications, administration, data processing and document handling services. Tong and Gong (2020) stated that In Malaysia, just 25% of small and medium-sized enterprises (SMEs) sped up their plans for digital transformation in

response to the Covid-19 outbreak, while 60% slowed down. During the pandemic Covid-19 crisis, a company's financial flow significantly impacts its digitization activities. It's questionable whether significant increases in SME digitization can be made during the pandemic due to tight financial limitations. During the Movement Control Order, Tong and Gong (2020) stated that 84% of SME experienced problems with their online connectivity and communications with clients and vendors.

In addition, several SME claimed poor work-from-home (WFH) accessibility (Ernst and Young, 2020). The low levels of back-end digitization among SMEs prior to COVID had a negative impact on their productivity, efficiency, and company operations during the MCO. This will indirectly be affected on the cash flow problem which is no income but need to have compulsory payment to pay. Because of this change the employee and employer have 2 challenge of culture change, that mean the change come from by applying LSS to the business and the change of the new way on how to run the business due to the pandemic Covid-19, employee and employee need to work together to accept and overcome the culture change together. Not only that, LSS is a new method, and some SMEs are not familiar with this method, unable to do LSS because the work culture is not ready to accept, lean six sigma analysis requires a long time, SME are not familiar with this culture and take time to implement LSS (Julian et al., 2020). All this change needs to adapt to ensure the successful of this success factors. Because of that reason, this success factors irrelevant to be apply.

4.3 Objective 3: To recommend do(s) and don't(s) in implementing Lean Six Sigma at SMEs in the era of pandemic Covid-19.

This section will suggest the recommendation for the irrelevant success factor that has been decided in the previous objective. Three of the four most common success factors are irrelevant and need to make recommendations to give some idea to the SMEs on how to encounter the obstacles in way to help achieve success in implanting LSS at SMEs. In this objective, dedicated code is used for each recommendation. For example, (Y1, Y2…Yn) is used in recommendations of do(s), and (N1, N2…Nn) is used in recommendations of don(s).

4.3.1 Training and education

For this most common success factors, training, and education for LSS need good financial resources to take the program course. In this pandemic, SMEs are indeed having financial problems due to lockdown and making it difficult for SMEs to operate as usual to the detriment of their income. Therefore, to achieve this success factor, SME income must be stable. Therefore, the following are recommendations to ensure that SME income during the pandemic always runs as usual and also recommendations on how to implement these success factors effectively:

4.3.1.1 Recommendation for Do(s)

Y1-1 Offer both synchronous and asynchronous possibilities for engagement and learning.

- Participants can engage with their instructors and peers through synchronous aspects, which also helps them better manage their time and stay up with the required coursework. Due to the limited direct contact with people because of pandemic Covid-19, the instructors have to provide live lessons through videoconferencing software that enables participants to participate actively. This can ensure that the worker actively follows the learning program of LSS during the pandemic Covid-19.

  Asynchronous features, on the other hand, provide both flexibility and the opportunity for participants to study at their speed, which is beneficial for maintaining a healthy work-life balance and for participants who live in various time zones. The instructor is responsible for recording and posting live courses and participating in online discussion forums. This method can ensure the participants can study independently and have time to study without any time pressure.

Y1-2 Make changes on teaching style to make it more suited to online learning.

- Adapting teaching methods to the online environment aids participants' motivation, learning, and overall well-being. For example, shorter lectures

because lengthy screen periods negatively influence student performance. Limit the required group work since pupils struggle to connect with others and collaborate because of the Movement Control Order (MCO) during the pandemic Covid-19. Remote Teaching and learning are not the same as in-classroom instruction. Consider diversifying materials and course requirements to encourage student engagement, such as providing various tools and materials to encourage student participation.

Y1-3 Build in feedback system or forum

- This continuous training in LSS can be proceeded via virtualized to ensure that the learning activity can be conducted in the pandemic Covid-19 situation. The LSS consultant needs to build in feedback system or forum with the employee. This ensures that keeping up the interaction between the LSS consultant and employee is crucial to ensuring that online learning is effective. In addition, the employees will be able to find out how well they are doing through a feedback system or a forum, which will allow them to work on improving the areas in which they are struggling and get the assistance they require.

Y1-4 Pay attention to financials and cost optimization

- The first 2020 plan that should be revised is the cash flow projection. First, start with your existing cash situation and then predict cash inflows and outflows. (These forecasts are essential even during prosperous times, especially during recessions.) Next, create cash flow projections based on various revenue scenarios, including level sales, a modest decline, and a significant decline. This will ensure that SME can manage the financial with properly. Besides that, during economic downturns, the initial response is frequently to reduce expenses. However, the spending should be focused on the products and services that are most in-demand and make the most money, as well as on your biggest customers, who bring in the most money.

4.3.1.2 Recommendations for Don't(s)

N1-1 Don't do online training without online assessment and attendance taken

- This method and rules can ensure that the workers always be present and focus on teaching because an online assessment must be completed. This can ensure that employees who take the course can stay on the course and make the course more effective with the follow-up by the assessment.

N1-2 Don't share recorded lecture to participants that do not attend 100% in class

- The recorded lecture is essential to the participants. It is beneficial when participants must study by themselves before the exam. Recorded lectures help effectively and help a lot for the participants to study before their exams. In the presence of this rule, the participant had to attend all lectures to access recorded lectures at the end of the class session.

N1-3 Don't have a plan for the business

- Long-term and short-term planning must be incorporated into SME planning. The plan should be able to forecast where the company will be in two to five years by outlining precise goals and results that can be measured. Due to the pandemic Covid-19, planning is essential to ensure that the business is well prepared, knows what to do, and can handle the pandemic obstacles. The inability to plan will decrease the organization's efficiency, which may even lead to its entire dissolution.

4.3.2 Leadership, Project Teams management skill

4.3.2.1 Recommendation for Do(s)

Y2-1 Assign work based on strength (Utilizing and enhanced team weaknesses & strength)

- To make the proper decisions and successfully manage our teams, leaders must have a unique style and be familiar with the business and the people employed. During the pandemic Covid-19, the leader needs to understand the challenge and obstacles businesses face and know the team's ability to manage the company during the pandemic crisis. A good leader who knows the business and team's ability will utilize them and provide an excellent solution to overcome the challenge to the business during the pandemic Covid-19. After identifying and offering opportunities to grow the team's strengths, consider assigning tasks based on individual strong points. This may involve reorganizing roles to maximize the team's ability to produce results.

  Leaders can also delegate leadership tasks once leaders recognize the strengths within the team, choosing individuals to contribute to the group in a way that uses their innate abilities. So, understanding the company goals, vision, mission, and the team's ability will ensure the leader can manage and create a solution for the company to survive during the pandemic crisis.

Y2-2 Offer both synchronous and asynchronous Communication

- One of the most challenging aspects of managing a remote workforce due to the pandemic Covid-19 is determining the most efficient method of communication with each individual (without interrupting their workflow). The team's productivity will be aided by both synchronous and asynchronous communication. Real-time synchronous communication takes place when at least two people are exchanging information simultaneously with each other. This type of communication is known as "synchronous." This form of communication can also be virtual, and it can be scheduled or impromptu.

During pandemic Covid-19, synchronous communication can be implemented by using video conferencing such as zoom, WebEx or Microsoft teams. The availability of synchronous communications creates the possibility for more in-depth discussions. Consider holding meetings at which members of the teams can engage in lively conversation to generate ideas or find solutions to challenges. Because of asynchronous communication, workers no longer need to divert their attention to address requests that are either unnecessary or laborious. It removes the pressure to act immediately on things that are not urgent, eliminates distractions, and lets the worker focus better and feel less stressed, this is very important during the pandemic period to ensure that the team is under less pressure and always keeps the team harmony. It allows the leaders to effectively communicate with distant employees located across various time zones. This kind of method can enhance the team's performance during the pandemic Covid-19.

Y2-3 Frequently monitor and follow up teams

- This can be done by having a weekly discussion to discuss any issue regarding the business and the employee manner. Leaders can also provide Question and Answered (QnA) sessions with the teams to ensure that the teams have a platform to ask anything that is unclear to them regarding the new norms of working style. This method can allow the teams to work well together and be more systematic in dealing with problems that arise by avoiding confusion.

Y2-4 Enhance harmony among teams

- Due to the pandemic, leaders and employees should understand the company management well. Both parties are interdependent on each other. Without good leaders, teams do not have direction, and without good teams, leaders will not succeed in managing the company. Therefore, both parties need to work together and support each other. In addition, openness (transparency), communication, and information exchange among employees, as well as learning, are a principal focus of the company. This principle will make fewer individuals feel scared and

anxious about speaking out or concealing mistakes for fear of shame or repercussions. Instead, treat everyone with respect and share ideas.

During pandemic Covid-19, there were a lot of obstacles that companies faced which are in terms of financial, uncertain supply chain activity, fewer operating hours, and unstable market demand. Problems like these require each group member to give their individual opinions to find a solution. Leaders will not be able to solve the problem without help from the team. Therefore, it is crucial for leaders to always keep the teams in harmony because harmony in teams can improve productivity and bring better business performance results.

4.3.2.2 Recommendations for Don't(s)

N2-1 Do not hire or be leaders who lack of strategic thinking

- Leaders lacking strategic thinking abilities cannot analyze situations and identify the measures necessary to achieve their objectives. This indicates poor leadership, as individuals in control are expected to guide the team to success. No one has all the answers, but strategic thinking is a talent that can be developed through practice and learning. A significant element of a bad leader's downfall is their excessive reliance on oneself to make decisions instead of their systematic approach to the task. Strategic thought encompasses not just the leader but also the company, team members, and surroundings. This problem will ensure the leader cannot guide the teams during the pandemic Covid-19 situation.

N2-2 Do not have a lack communication among leaders and teams

- Poor leader ignores their subordinates. They value none of their workers' contributions. These leaders will place low importance on listening to their staff and may even interrupt them when they are speaking in order to talk themselves. A weak leader will not regard worker viewpoints, even if they come from employees with substantial knowledge and expertise in the subject under discussion. Consequently, individuals may overlook opportunities to perform tasks more effectively and efficiently. In addition, poor leaders frequently neglect to provide their employees with information on the policies and procedures they

must follow and then criticize or punish individuals who do not comply. This kind of communication will lead to the failure of the SME during the pandemic Covid-19 because there are do not have harmonies and communication to solve the problem faced by the organization.

4.3.3 Culture Change and Organization Culture

4.3.3.1 Recommendation for Do(s)

Y3-1 Guide the team in creating new norms, processes, and goals (Provide clear SOP)

- Leaders must conduct a "working from home" relaunch to assist their teams in adjusting to the new circumstances. Relaunches are resets, whereas team launches establish the course of a group at the moment of its formation. The COVID-19 pandemic disrupting routines necessitates relaunches to enable leaders and team members to comprehend how each member has been affected, determine how to address issues, and eventually get everyone back on track to meet team objectives. To achieve success in this recommendation, leaders need to make a clears Standard Operation Procedure (SOP) on the new Norma style of working in the period of pandemic Covid-19. This can ensure the workers clears about the instructions and their tasks to avoid any confusion to the change of working style. Next leaders can follow up frequently, which means the leaders need continued efforts to obtain feedback from employees on how the teams may improve to ensure that the team has guidance in accepting culture change regarding the new normative working style during the Covid-19 pandemic period. By doing this, leaders and teams are constantly updated with the problem or issue in the team management skills and alert to overcome the problem.

Y3-2 Create Reward System (Individual and Teams)

- A few team members will absorb the new culture and aggressively promote its adoption, while others may not be easy to adapt to change. One way to deal with this is to devise a strategy for publicly rewarding individuals who take the time and effort to accept change—especially those who do it with a positive attitude and can help other team members. Of course, change is unavoidable, but when done correctly for the first time, it is far less traumatic. As a result, establishing a reward system will aid in increasing the speed of change, maintaining strong morale throughout the process, and indirectly improving company performance in SMEs.

Y3-3 Support Those Affected by the Change

- Staff and employees may react to changes in the organization of their department in very different and vague ways. During this period, individuals look to their leaders for help and encouragement, and the support and motivation leaders may positively affect their future and the teams. Employees and employers need to support each other in a situation with many obstacles due to the pandemic. For example, during the work from home (WFH) method, employees need to support the employees who have an issue with a slow internet connection. Besides that, to show support for the employees, the employer must prepare the tools for the worker to do their work from homes, such as laptops, hand tools, and other things the employees need. This kind of support will ensure that the employees are more confident to accept the change regarding the method of work and the method of implementing LSS in the company. Hence, good bonding and having the same team mindset will help the employees to accept the culture change in the organization efficiently and will help to achieve success.

Y3-4 Change the behavior and mentality towards change

- Everyone has their own way of accepting change. There are employees who are able to handle and accept and unable to accept change. If the current behavior is a barrier to achieve the acceptance of the change in implementing LSS in the era

of pandemic covid 19, do not afraid to entertain the thought of changing the bad behavior as soon as possible. A more positive mindset among the employees will ensure that acceptance of change will be more easily.

4.3.3.2 Recommendations for Don(s)

N3-1 Do not extreme criticism

- There is constructive criticism, and then there is abusive criticism. A toxic work environment can be described as one in which an employer consistently expresses discontent with the work of its employees and fully belittles their efforts. Conversely, a positive working environment never employs destructive criticism and instead inspires, supports, and recognizes its employees for their efforts. To achieve success of adapting the culture change this kind of working environment will fail employees to adapt culture in a company. This will lead failure of a company, especially in a Covid-19 pandemic which requires organizations from top management to the bottom must help and support each other to strive to adapt to a culture that has changed in terms of work, communication methods, and organizational strategy.

N3-2 Do not lack of team bonding and communication.

- A toxic work atmosphere makes it difficult for employees to communicate effectively with one another. As a result, they aim to avoid social connections with other employees as much as possible. Employees often do not show any emotional relationship with one another. Employees only desire to finish their work and leave the workplace as soon as possible. Employees only communicate when their duties need them, this condition resulting in a generally gloomy workplace atmosphere.

  In an organization, employees must work and help each other, including leaders. This is because, due to the presence of Covid-19, workers face many uncommon cultures, for example, work from home and business management, which requires implementation by digitalization such as accounting, communications, administration, data processing, and document handling

services. SMEs are unfamiliar with this culture and take time to implement the new change in the organization. This employee, including leaders, should help each other to learn and teach other employees so that all employees quickly understand the new way of work, which can have a good impact on the company.

CHAPTER 5

CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

In a nutshell, this study had previously achieved all three objectives stated in Chapter 1. For Objective 1, the results were obtained from the 150 references that have been read. Fifty references are read to find out the impact and obstacles of pandemic Covid-19 on SMEs operations and 100 references have been read to determine LSS success factors. After that, the statistic frequency of LSS success factors that have been mentioned in the 100 references is done to find out the most common success factors, which is the success factors are more than 50% are mentioned in the 100 references. This project obtained the four most common success factors from the analysis. The results of the most common LSS success factors are as follows:

I. Top Management involvement and communication
II. LSS Training, education, and Understanding of the LSS methodology, tools and techniques used
III. Leadership and Project Teams management skill
IV. Culture Change and Organization culture

For objective 2, this study has also successfully analyzed the relevancies of the most common LSS success factors. In objective 2, the comparison method is used for the analysis to compare the impact and obstacles of pandemic Covid-19 to SME and the most common LSS success factors. The relevancies status of each of the most common LSS success factors is decided after the deep analysis of the obstacles in covid 19 to SMEs operations with the

LSS most common success factors that identified through literature studies. Table 5.1 presents the status of the relevancies of each of the most common success factors.

Table 5. 1: Summary of Relevancies Status

LSS Most Common Success Factors	Relevancies Status
Top Management involvement and communication	Relevant
LSS Training, education on understanding of the LSS methodology, tools and techniques used	Not Relevant
Leadership and Project Teams management skill	Not Relevant
Culture Change and Organization culture	Not Relevant

For objective 3, solution was recommended do(s) and don(s) to improve the implementation of the irrelevant success factor in SMEs in the era of pandemic Covid-19. Table 5.2 presents the summary of the recommendation each of the most common success factors that irrelevant.

Table 5. 2: Summary of Recommendation Do(s) and Don(s)

Cluster no.	Irrelevant LSS Most Common Success Factors (In era Covid-19)	Do(s)	Don(s)
1	LSS Training, education on understanding of the LSS methodology, tools and techniques used	**Y1-1** Offer both synchronous and asynchronous possibilities for engagement and learning. **Y1-2** Make change on teaching style to make it more suited to online learning **Y1-3** Build in feedback system or forum. **Y1-4** Pay attention to financials and cost optimization	**N1-1** Don't do online training without online assessment and attendance taken. **N1-2** Don't share recorded lecture to participants that do not attend 100% in class. **N1-3** Don't have a plan for the business.

Table 5. 2: Summary of Recommendation Do(s) and Don(s) (continue)

Cluster no.	Irrelevant LSS Most Common Success Factors (In era Covid-19)	Do(s)	Don(s)
2	Leadership and Project Teams management skill	**Y2-1** Assign work based on Strength (Utilizing and Enhance team weaknesses & strength) **Y2-2** Offer both synchronous and Asynchronous Communication **Y2-3** Frequently monitor and follow up teams **Y2-3** Enhance Harmony among teams	**N2-1** Do not hire or be leaders Who lack of strategic thinking **N2-2** Do not have a lack communication among leaders and teams
3	Culture Change and Organization culture	**Y3-1** Guide the team in creating new norms, processes, and goals (Provide clear SOP) **Y3-2** Create Reward System (Rewarding teams Appropriately for good performance). **Y3-3** Support Those Affected by the Change. **Y3-4** Change the behavior and mentality towards change	**N3-1** Do not extreme criticism **N3-2** Do not lack of team bonding and communication.

5.2 Limitation of the Study

Even though this study had successfully achieved all the objectives, but there is still numerous limitations in this study:

I. Lack of prior research studies on the topic

This limitation occurs in collecting the journal and article regarding challenge and obstacles Pandemic Covid-19 to the SMEs. This is because the pandemic started less than three years from the date of this study. Therefore, not many studies have been done on the topic. This makes it challenging to collect journals and articles as reading material to collect data.

II. Limited time for reading the references

Data from this study were entirely obtained from journal readings and articles from previous studies. This study requires 150 references to be used as reading material to collect data from previous studies for this study. Therefore, reading the entire references must take a long time. This is because each journal and article must be read carefully and accurately analyzed. So that the results of this study achieve the right objective.

III. Limited Data Collection

Due to the pandemic, the data collection for this study only from reading material that the previous study has done. To ensure that the research has good data collection, an interview method direct to SME industries needs to be done. This procedure ensures that the researcher directly gets the data from the real SME industries. However, all this cannot be done because of the rules and Covid-19 Standard Operations Procedure (SOP) to prevent the spread of Covid-19 outbreaks.

5.3 Complexity

The complexity of this study is collecting journal articles regarding the challenge and obstacles of Pandemic Covid-19 to SMEs for the data collection. This complexity occurs because the pandemic started less than three years from the date of this study. Therefore, not many studies have been done on the topic. This is one of the main challenges in completing this project. The next challenging complexity in this project is determining and analyzing

the relevancies status of most common LSS success factors. To state the relevancies status, it needs a lot of components and elements, such as the impact and obstacles of Covid-19, the fundamentals of the success factors, and the SME's ability level to implement the success factors in their business during the pandemic Covid-19. All of this must be excellently considered to achieve accurate results and solutions for this project.

5.4 Lifelong Learning

At the end of this project, it shows the relevancies status of the most common LSS success factors when implemented in the SMEs during pandemic Covid-19. From the results, 3 of the cluster's most common LSS success factor is irrelevant to be implemented because of the obstacles and impact of the pandemic Covid-19, which prevents the success of the LSS success factors. The relevancies status of the most common LSS success factors is essential to ensure that the SMEs and engineers know the problem and the way how to overcome the problem. Besides that, this research also comes with the recommendation do(s) and don(s) to help the SMEs industries. The recommendation can be a guideline for implementing LSS in the era of pandemic Covid-19 successfully. The outcome of this project will bring many benefits to all types of SME industries to implement LSS correctly and well in the era of pandemic Covid-19 and, most importantly, to the future research as an information and idea to start the new study in the future.

5.5 Sustainability

In this project there have many benefits gained from this study. First, achieving all three objectives in this project impacts the SMEs industries, which can help as a guideline for SMEs to plan and manage their strategy during the pandemic Covid-19. Not only that, this project also identifies each problem that occurs in the SMEs during the pandemic Covid-19, which is essential in term of social system study in the era of pandemic Covid-19. This

study's results can contribute to understanding the new norma of the social system during the pandemic.

5.6 Recommendations for Improvement for Future Study

As well known, starting from 1 April 2022, Malaysia and various countries worldwide will transition from pandemic to the endemic phase of Covid-19. For a future project, some recommendations can be proposed. First, the researcher needs to analyze the relevancies status of the most common LSS success factors in the transition to the endemic phase of Covid-19. It is essential to state a new clear relevancies status of the most common LSS success factors, whether already relevant or still irrelevant, to be implemented during the endemic transition phase.

Next, the recommendation do(s) and don(s) from this project needs to be implemented at SME in the context of the endemic Covid-19 phase. Future research needs to be studied regarding the relevancies status and the impact and obstacles during the new phase of endemic to get the effective and the best recommendation do(s) and don(s) to guide SMEs industries to implement LSS in the era of pandemic and endemic Covid-19 period.

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APPENDICES

A. ReferencesCode Number

CODE	JOURNAL AND ARTICLES
1	(Jeyaraman & Teo, 2010)
2	(Setijono et al., 2012)
3	(Abu Bakar et al., 2015)
4	(Antony et al., 2012)
5	(Ribeiro de Jesus et al., 2016)
6	(Achanga et al., 2006a)
7	(Antony & Banuelas, 2002)
8	(Habidin & Yusof, 2013a)
9	(Ainul Azyan et al., 2017)
10	(Sisson & Elshennawy, 2015)
11	(Siddiqui et al., 2016)
12	(Henderson & Evans, 2000)
13	(Antony & Bhaiji, 2004)
14	(Pillai et al., 2014)
15	(Peter S.Pande et al., 2000)
16	(R. Snee & Hoerl, 2004)
17	(Coronado & Antony, 2002)
18	(Antony, 2006)
19	(Mahāwitthayālai Thammasāt., 2011)
20	(Revere et al., 2006)
21	(Hahn et al., 1999)
22	(N Ramapatna, 2015)
23	(Fadly Habidin, 2008)
24	(Kwak & Anbari, 2006)
25	(Zu et al., 2010)
26	(M. Kumar, 2007)
27	(Brun, 2011)

28	(Mark D, 2001)
29	(Achanga et al., 2006b)
30	(Johnson & Swisher, 2003)
31	(Habidin & Yusof, 2013)
32	(Timans et al., 2012)
33	(Assarlind et al., 2012)
34	(Antony, Krishan, et al., 2012a)
35	(R. D. Snee, 2010)
36	(Gamal Aboelmaged, 2010)
37	(Masekwameng, 2020)
38	(Belhadi et al., 2019)
39	(Jha et al., 2019)
40	(Laosirihongthong & Saykhun, 2006)
41	(Sindhwani et al., 2019)
42	(Soti et al., 2010)
43	(Sreedharan et al., 2018)
44	(Zandhessami & Rahgozar, 2018)
45	(Yadav et al., 2021)
46	(Swarnakar et al., 2019)
47	(Yusof & Aspinwall, 1999)
48	(Hoang, 2015)
49	(Chan et al., 2014)
50	(Yurim Zagloel et al., 2018)
51	(Kowang et al., 2016)
52	(Norhafizan Hibadullah, 2014)
53	(S. Albliwi et al., 2014)
54	(S. A. Albliwi et al., 2015)
55	(Sabry, 2014)
56	(Stankalla et al., 2018)
57	(R. v. Sreedharan et al., 2018)
58	(Jadhav et al., 2014)
59	(Zhang et al., 2012)
60	(Lameijer et al., 2021)

61	(Lande et al., 2016)
62	(Laureani & Antony, 2018)
63	(Psychogios et al., 2012)
64	(Alhuraish et al., 2014)
65	(Chakrabarty & Tan, 2007)
66	(Elkhairi et al., 2019)
67	(Noori, 2015)
68	(Silva et al., 2019)
69	(Delgado et al., 2010)
70	(Kader Ali et al., 2016)
71	(Cherrafi et al., 2016)
72	(Desai et al., 2012)
73	(Vouzas et al., 2014)
74	(Anbari, 2004)
75	(Talib et al., 2014)
76	(Antony, Krishan, et al., 2012)
77	(Antony et al., 2012)
78	(Fryer et al., 2007)
79	(Amar & Davis, 2008)
80	(S. Kumar, 2015)
81	(Tsironis & Psychogios, 2016)
82	(Yi-Zhong et al., n.d.)
83	(M. Kumar et al., 2009)
84	(Näslund, 2013)
85	(Powell et al., 2017)
86	(Ben Ruben et al., 2018)
87	(Upadhye et al., 2016)
88	(Netland, 2016)
89	(Netland & Aspelund, 2014)
90	(McLean & Antony, 2014)
91	(Almeida Marodin & Saurin, 2015)
92	(Linderman et al., 2006)
93	(Schroeder et al., 2008)

94	(Näslund, 2008)
95	(Brady & Allen, 2006b)
96	(Karuppusami & Gandhinathan, 2006)
97	(Sila & Ebrahimpour, 2003)
98	(Motwani, 2001)
99	(Saraph et al., 1989)
100	(Laureani & Antony, 2019)

B. FYP 1 and 2 Gantt Chart